RACES

MVP

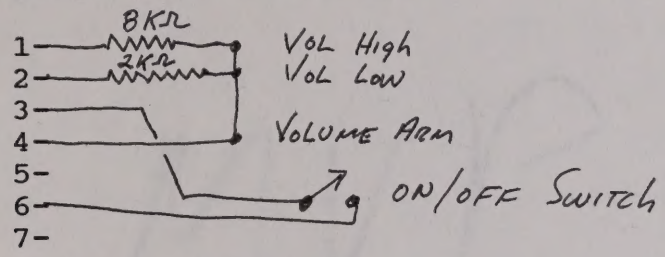
—RADIOS—

RACES Packet Radio

GE MVP setup for packaging as NetNode

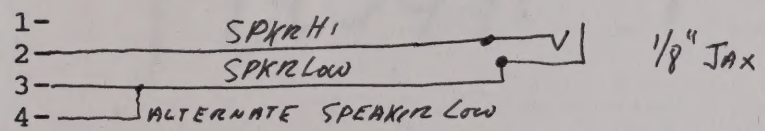
A. System-Audio-Squelch Board.

1. Modify plug P-905 as follows:



2. Eliminate: Squelch Switch and TX led.

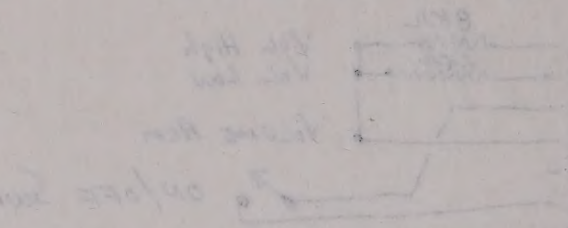
3. Add audio monitor jack to P-901:



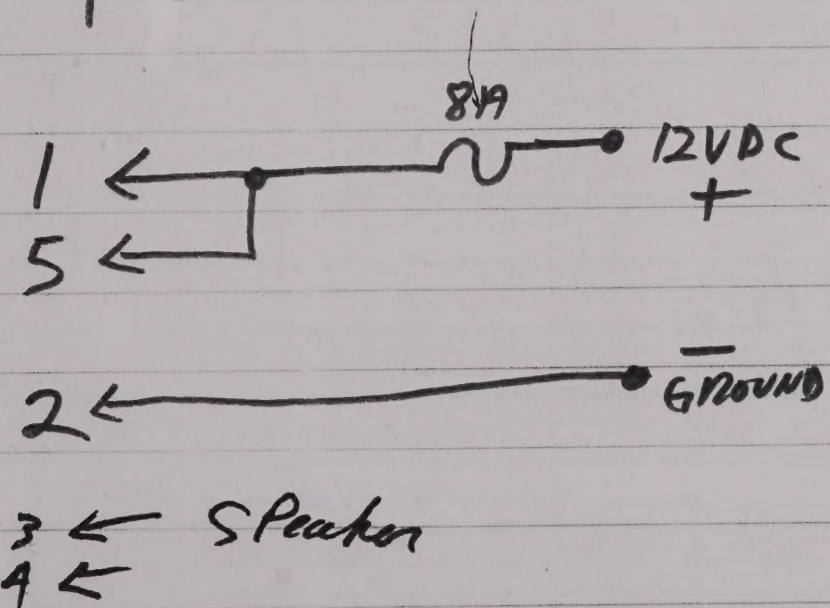
B. Jumper the RX Osc-Multi board DA H-9 to H8 for RX-F1 select.

C. Jumper the TX Exciter board junction C-109/R-105 to ground for TX-F1 select.

6/10/94
Walter N6LYF



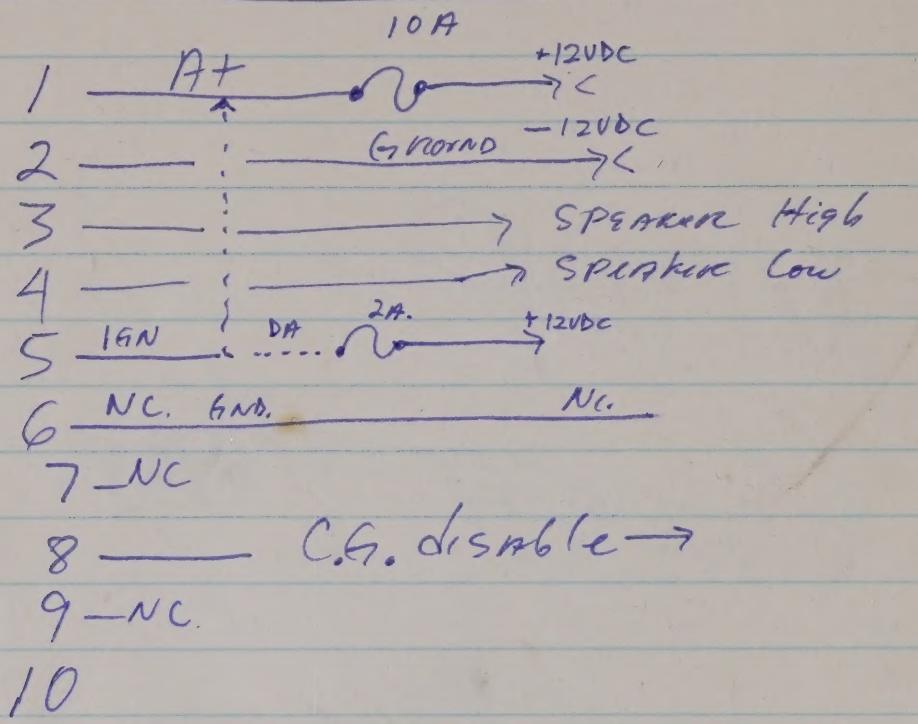
MVP Power Plugs



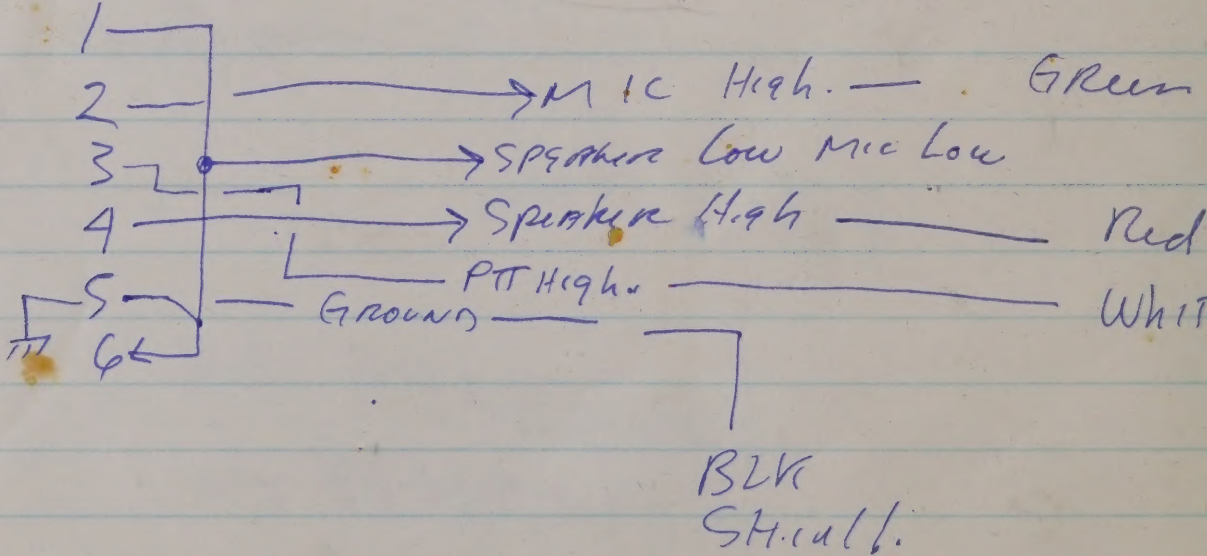
19A11588AP11 shell
19A11588AP8 pins

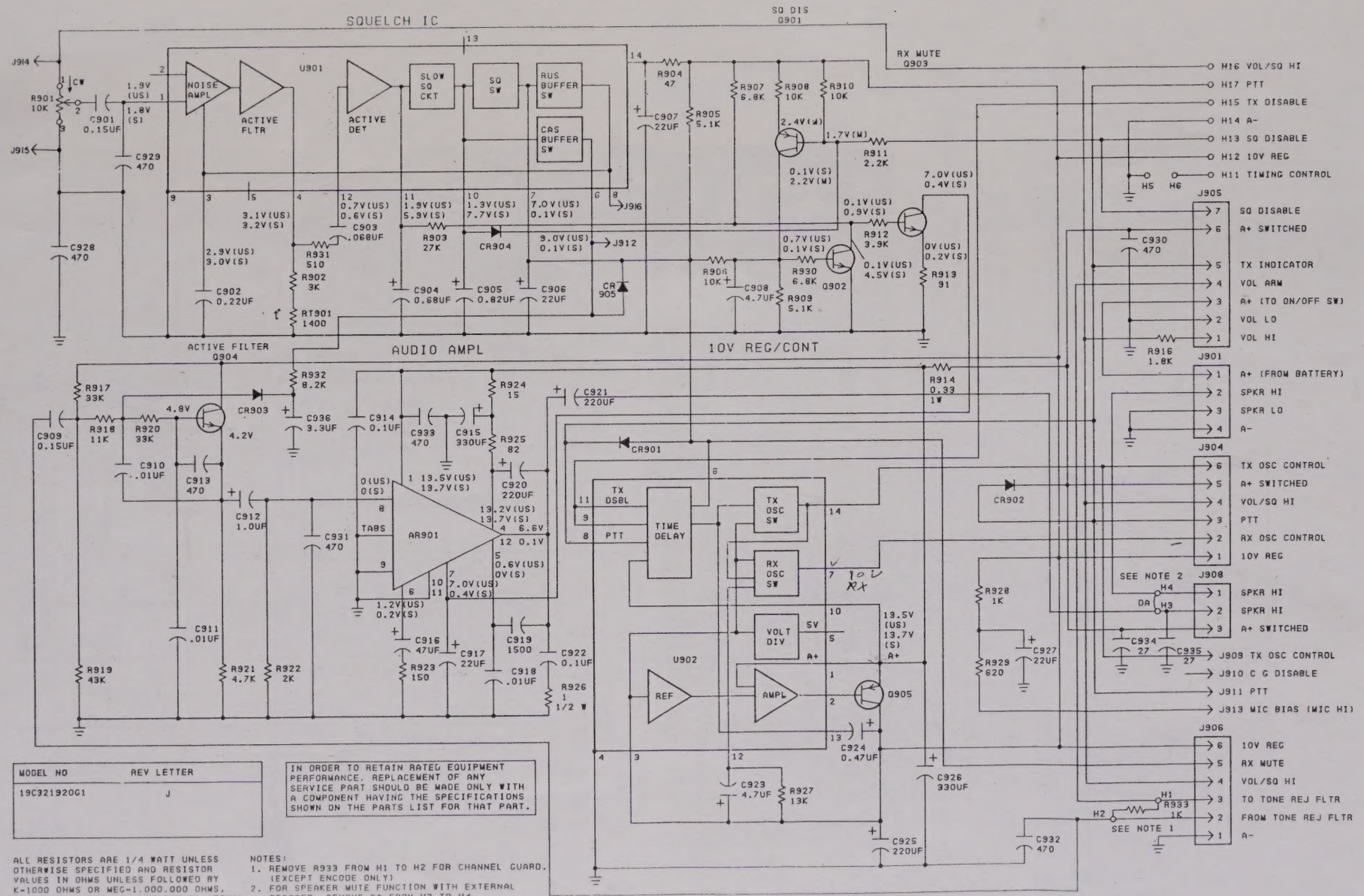
MVP

System Cable.



Mic Jack





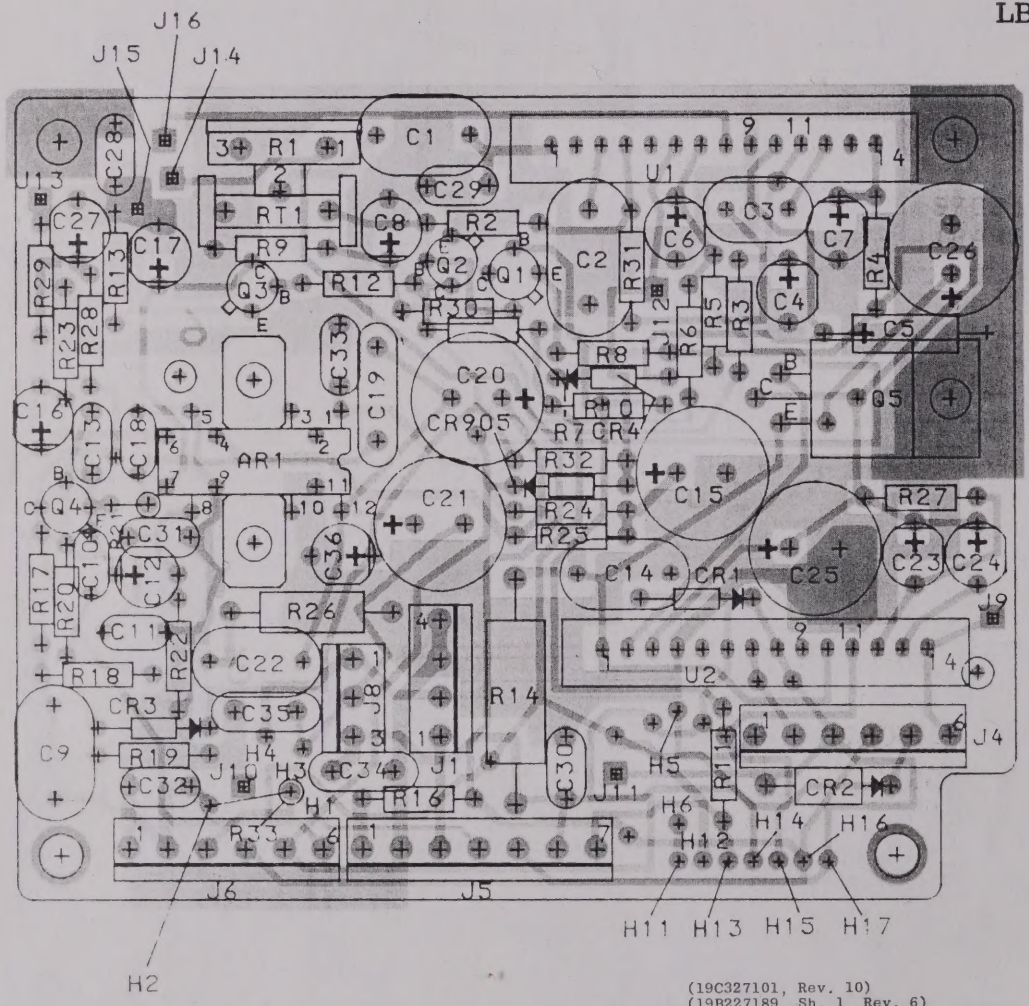
MODEL NO	REV LETTER
19C321920G1	J

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

NOTES:
1. REMOVE R933 FROM H1 TO H2 FOR CHANNEL GUARD. (EXCEPT ENCODE ONLY)
2. FOR SPEAKER MUTE FUNCTION WITH EXTERNAL DECODER, REMOVE DA FROM H3 TO H4.

SCHEMATIC

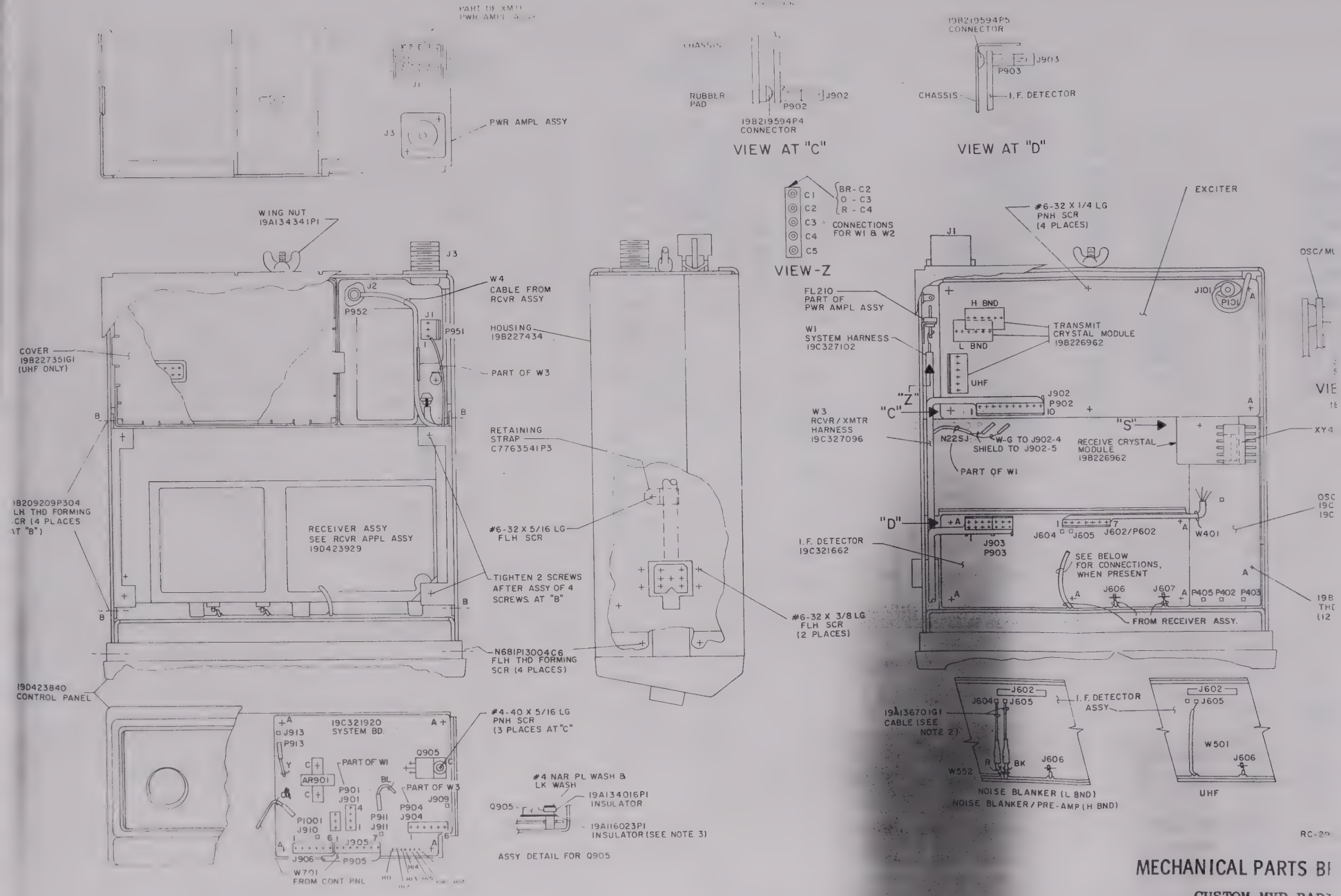


(19C327101, Rev. 10)
(19B227189, Sh. 1, Rev. 6)
(19B227189, Sh. 2, Rev. 6)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR COMPLETE DESIGNATION PREFIX WITH 900 SERIES.
EXAMPLE: C1-C901 , R1-R901 , ETC.

LEAD IDENTIFICATION
FOR Q1-Q4

REFER TO WIRING DIAGRAM
19D423734 FOR THE



RC-29

MECHANICAL PARTS BI

CUSTOM MVP RADI

Issue 3

EDACS

5-27-94

Enhanced Digital Access Communications System

CUSTOM MVP SYSTEM BOARD

Tx delay is 20ms
SET WITH C-924 Ø.47 MF
@ U9Ø2

Rx delay is 50 ms
SET WITH C-923 4.7MF
@ U9Ø2

To ADJUST

① Rx = 13KΩ 4.7MF = 60ms
Change C-923 TO → 1.0 MF = 13 ms

② Tx = 0.47 MF = 20ms
0.33 MF ≈ 15ms
0.22 ≈ 10 ms

MVP RADIO MODIFICATIONS FOR 9600 DATA MODEM.

June 29, 1993 by Walter Rheingans, N6LYF

These modifications give the following specifications.

Transmit modulation sensitivity: 4.0 volts peak-to-peak audio for 3.0 khz deviation. Frequency response is flat from 10 Hz to 8500 Hz.

Receive audio output: 3.0 khz incoming deviation results in 2.0 volts peak to peak audio output. Frequency response is good from 3 Hz to 7400 Hz.

A. Transmitter.

The transmitter is modified to modulate the crystal directly by means of the temperature compensating varicap diode in the crystal module unit that plugs into the exciter board.

1. On the transmitter exciter circuit board, add a 2.2 mf 25 volt capacitor across C-106. The purpose of this added cap is to prevent the modem modulation tone from modulating the receiver local oscillator thorough the compensation bus.

2. On the back of the crystal module, add a two post terminal strip by soldering the ground tab to the ground plane on the back of the module circuit board.

3. Construct a series circuit consisting of a 56 k ohm 1/8 watt resistor and a 2.2 mf tant. capacitor and solder the network from the varicap (cr-1) on the crystal module to the terminal strip. The (+) of the cap goes toward the varicap.

4. Add an .005 mf bypass cap to the terminal strip from the network (step 3-above) to the ground tab of the terminal strip.

5. Wire a shielded cable from the terminal strip and dress to the rear of the radio and exit through any convenient hole.

B. Receiver

The receiver is modified to increase the low frequency response of the detector output amplifier.

1. On the receiver IF-Detector board, change C-623 from 0.22 mf to 33 mf., and change C-627 from 22 mf to 470 mf. C-623 change extends the low frequency response of the output amplifier down to about 2 Hertz. With this change, it is essentially flat from 3 Hertz to 7400 Hertz. Increasing C-627 to 470 mf is to add low frequency stability to the amplifier power distribution bus.

2. Behind the front panel, at the system-audio board, connect the receiver audio output through a shielded cable connected at J-6 , #1 ground and # 4 audio high. J-6 is for connecting a CTCSS decoder and is not needed in this application, so solder directly to the pins of J-6.

3. Continue with the PTT connections below.

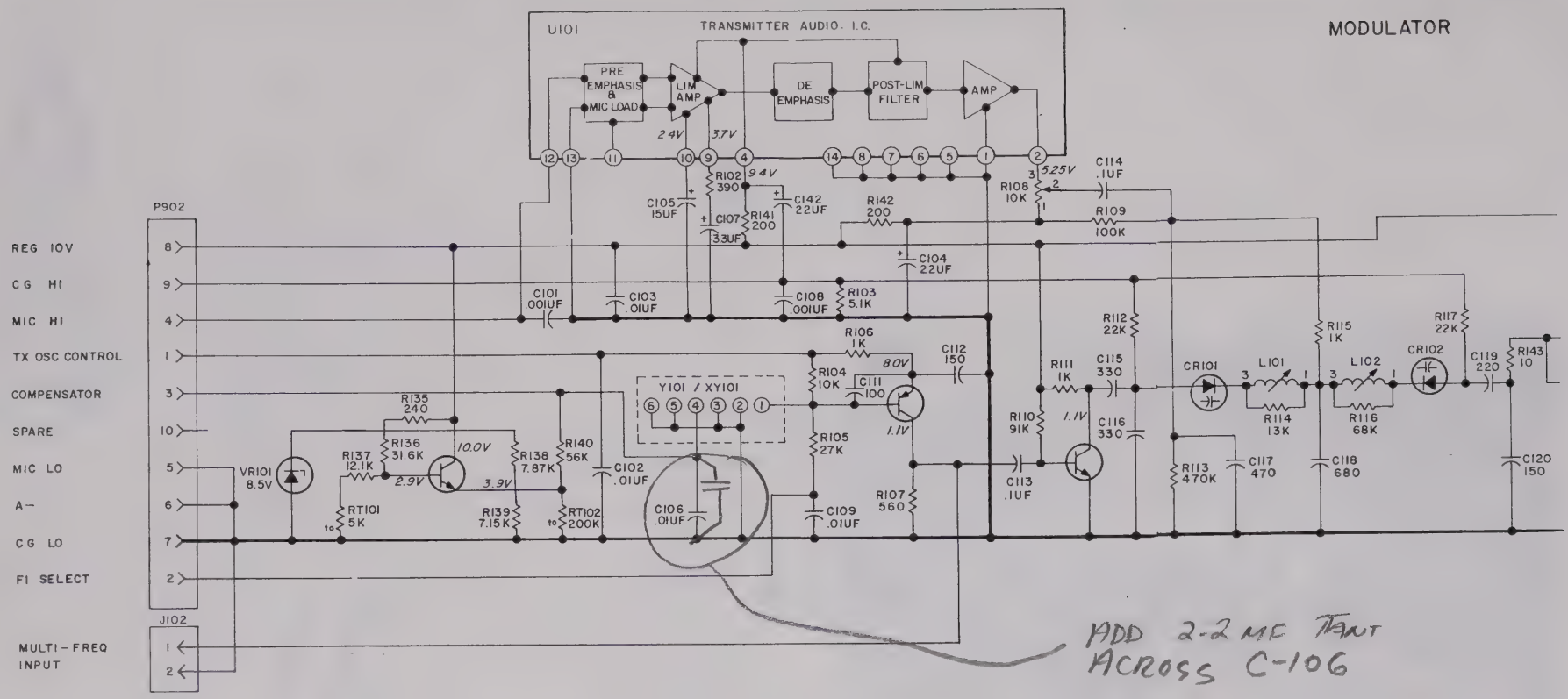
C. PTT Connection

1. While behind the front panel for the receive audio connections, connect a wire to hole H-17 on the system audio board to pick up the PTT connection.

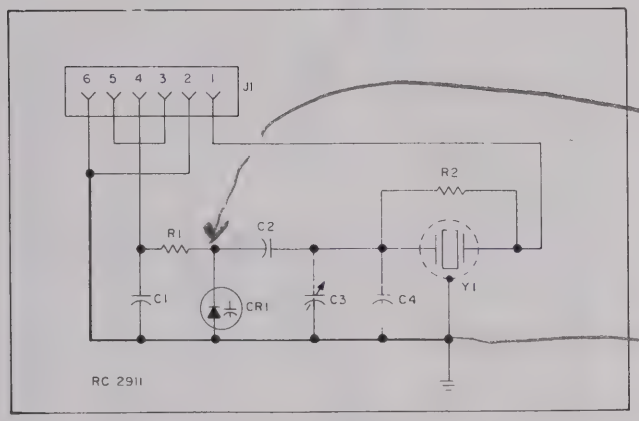
2. Dress the PTT wire and receive audio wire along the edge of the radio with the existing radio wiring and take to a convenient exit at the rear of the radio with the transmit modulation wire.

D. Schematic Diagrams

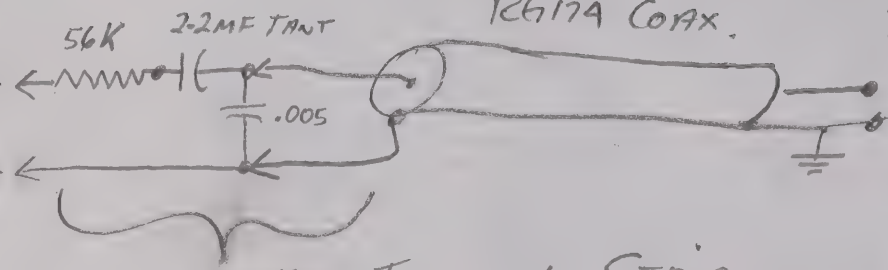
Attached are diagrams showing the changes and, where possible, board layouts showing the component locations.



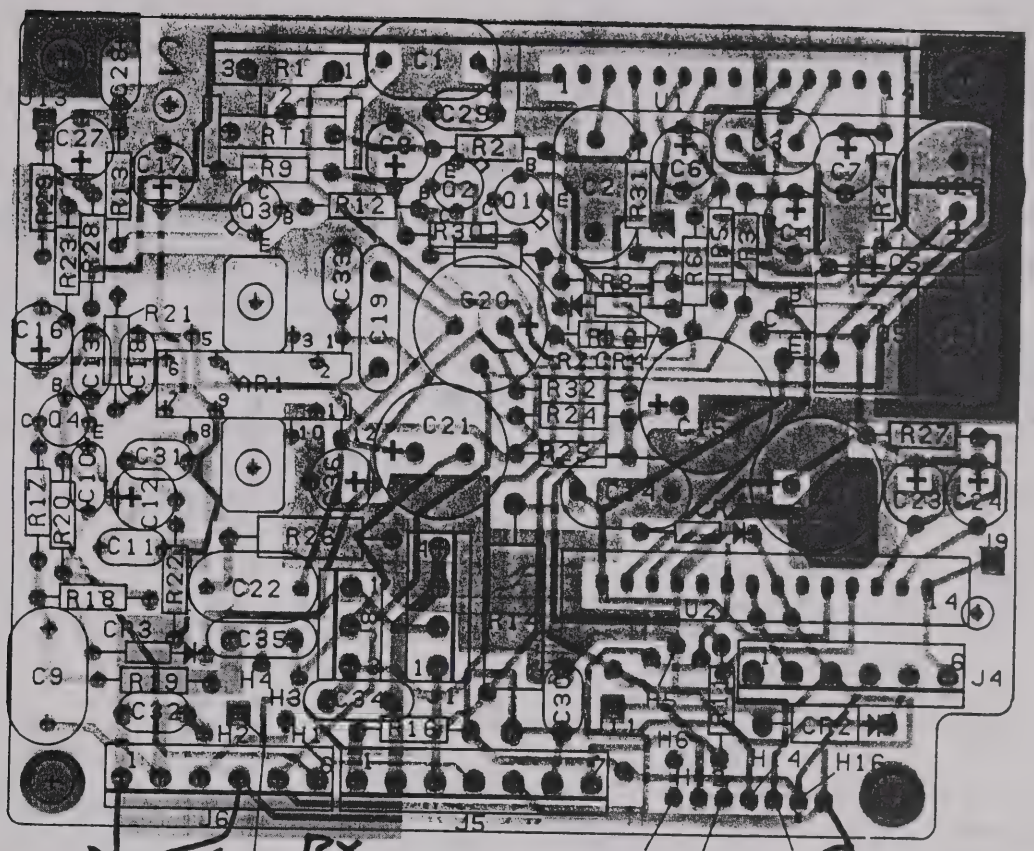
ADD 2-2 MF TANT ACROSS C-106



TYPICAL CRYSTAL MODULE



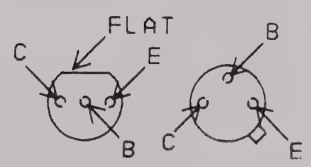
ADD TERMINAL STRIP TO BACK OF CRYSTAL Module.



(19C327101, Rev. 3)
(19B227189, Sh. 2, Rev. 2)
(19B227189, Sh. 3, Rev. 2)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR COMPLETE DESIGNATION PREFIX WITH 900 SERIES.
EXAMPLE: C1-C901 , R1-R901 , ETC.

LEAD IDENTIFICATION
FOR Q1-Q4



OR

IN-LINE TRIANGULAR

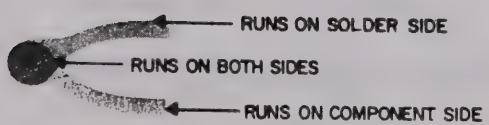
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

REFER TO WIRING DIAGRAM 19D423734 FOR THE FOLLOWING CONNECTIONS	
FROM	TO
H1	H2
H3	H4

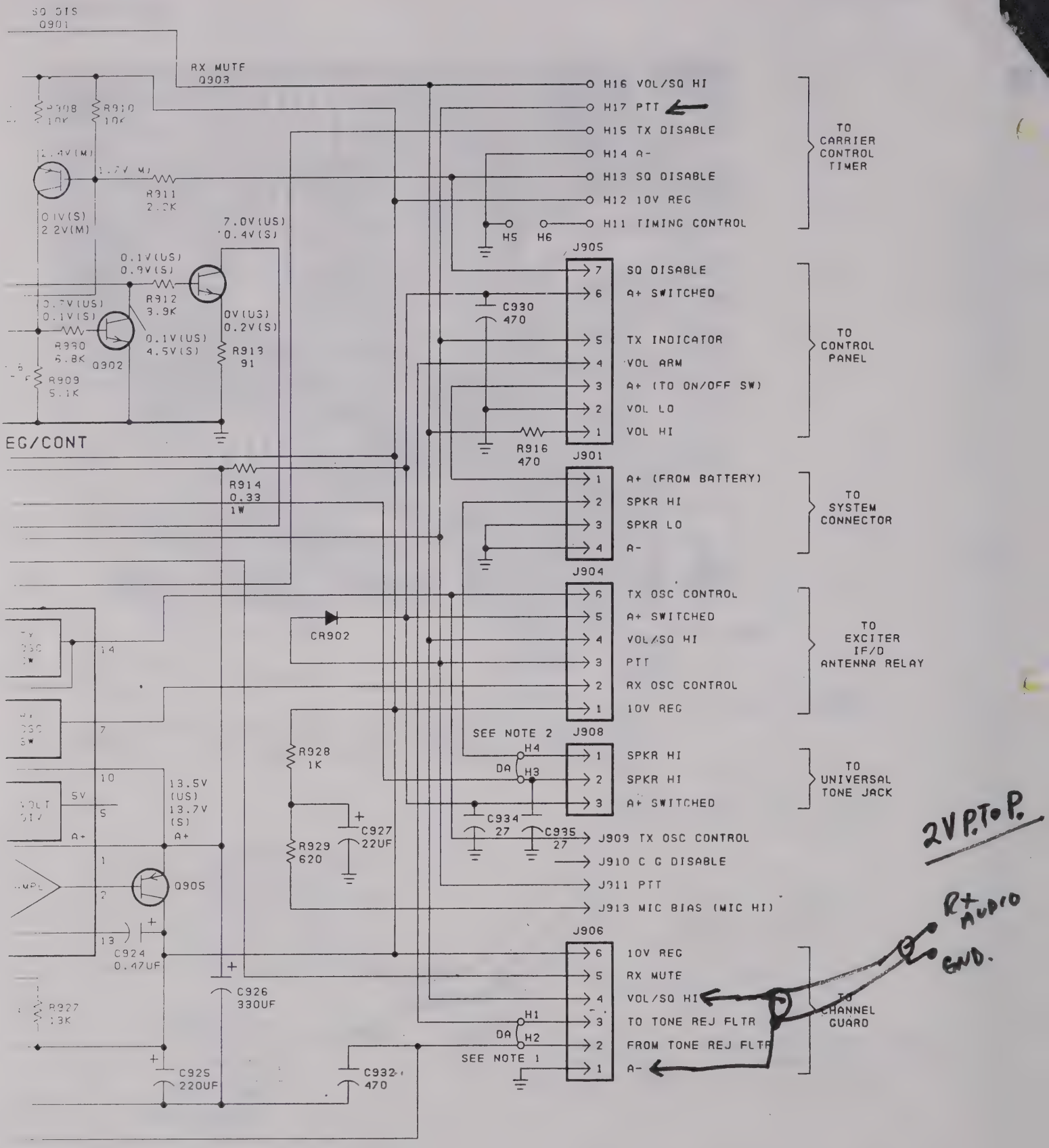
P.T.T
AUDIO
GND

AUDIO = 2V P.T.P. WITH 3.0 KHZ DEVIATION



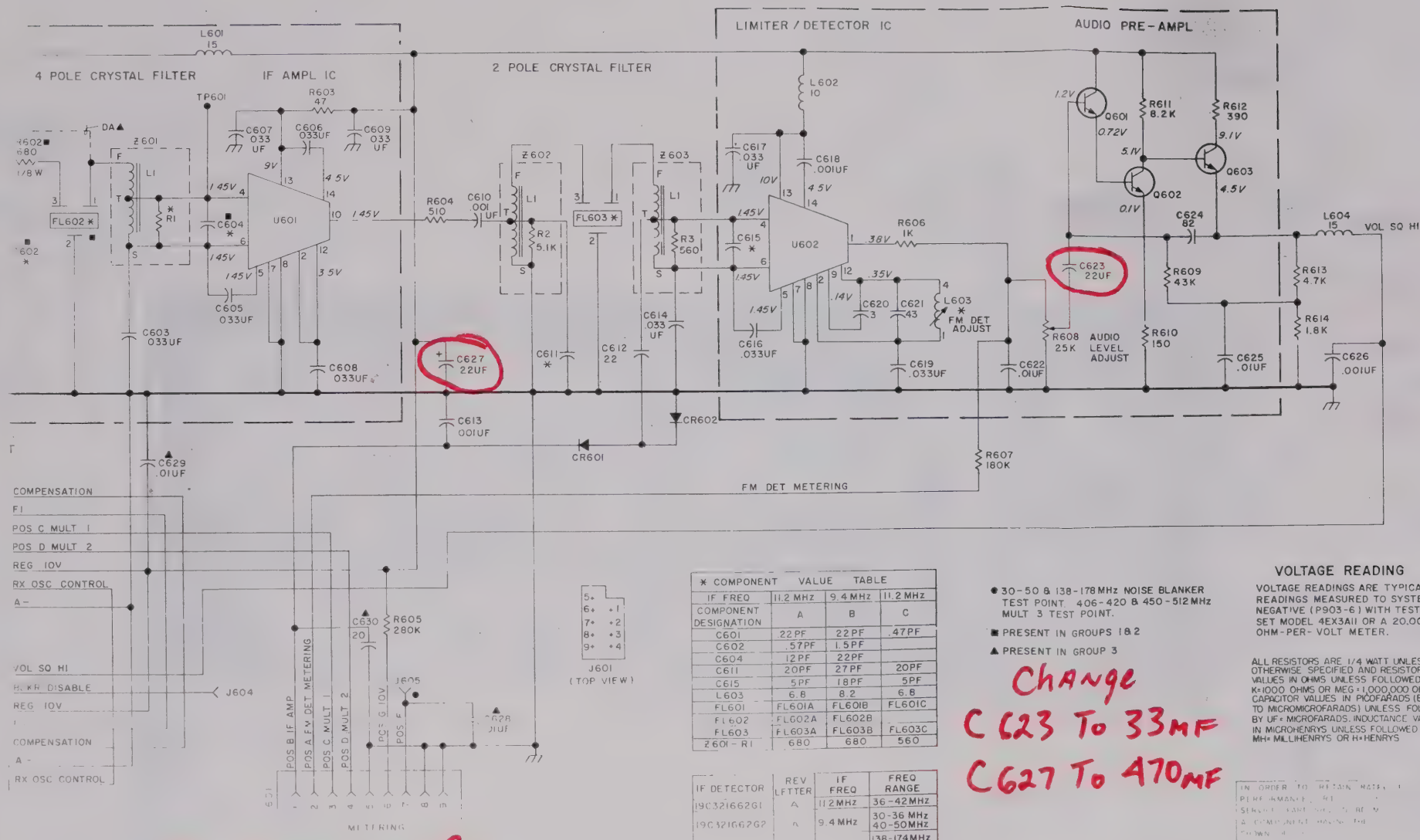
OUTLINE DIAGRAM

SYSTEM-AUDIO-SQUELCH BOARD
19C321920G1



SCHEMATIC DIAGRAM

SYSTEM-AUDIO-SQUELCH BOARD 19C321920G1



* COMPONENT VALUE TABLE			
IF FREQ	11.2 MHz	9.4 MHz	11.2 MHz
COMPONENT DESIGNATION	A	B	C
C601	22 PF	22 PF	.47PF
C602	.57PF	1.5 PF	
C604	12 PF	22 PF	
C611	20PF	27 PF	20PF
C615	5 PF	18 PF	5PF
L603	6.8	8.2	6.8
FL601	FL601A	FL601B	FL601C
FL602	FL602A	FL602B	
FL603	FL603A	FL603B	FL603C
Z601 - R1	680	680	560

IF DETECTOR	REV LETTER	IF FREQ	FREQ RANGE
19C321662G1	A	11.2MHz	36-42MHz
19C321662G2	B	9.4 MHz	30-36 MHz 40-50MHz
19C321662G3	C	11.2 MHz	138-174MHz 406-512MHz

● 30-50 & 138-178 MHz NOISE BLANKER TEST POINT. 406-420 & 450-512 MHz MULT 3 TEST POINT.

■ PRESENT IN GROUPS 1 & 2

▲ PRESENT IN GROUP 3

Change C623 To 33MF
C627 To 470MF

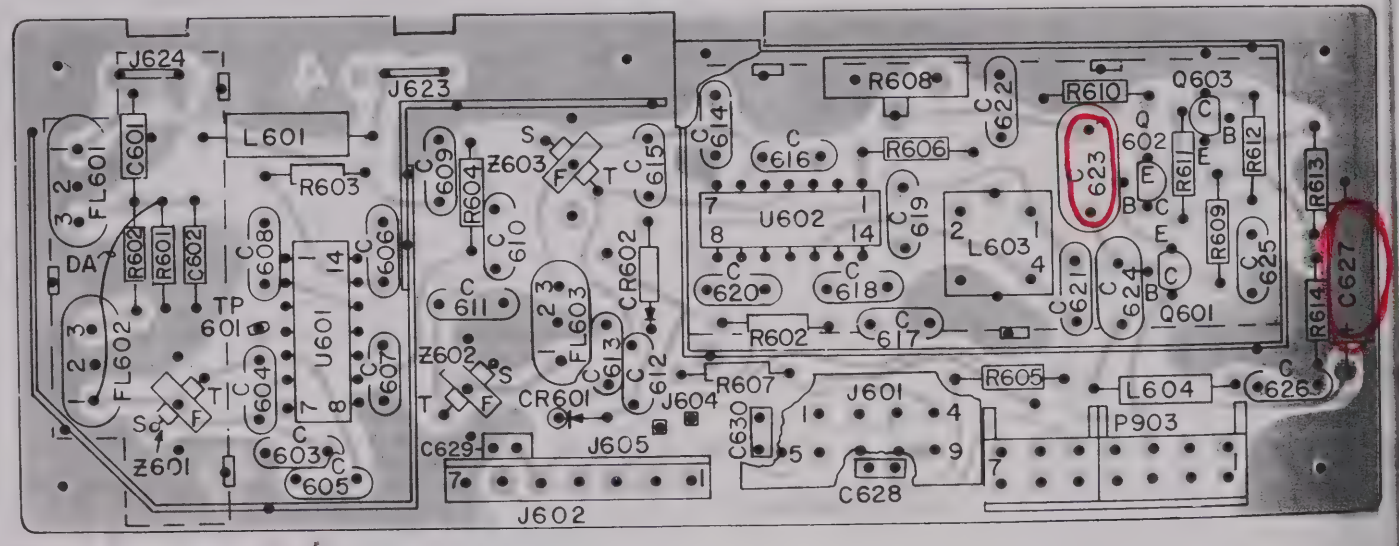
VOLTAGE READING

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-6) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS

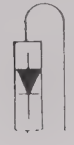
To Increase Rx Low Freq. Response.

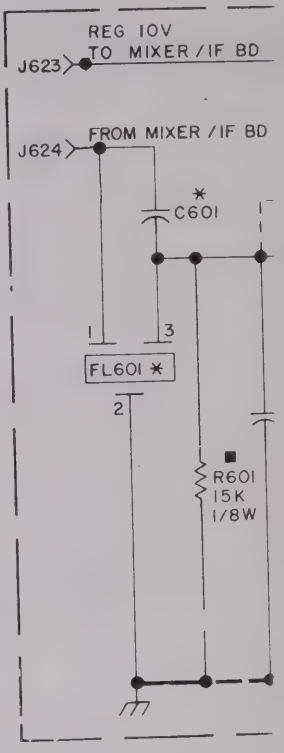
SCHEMATIC DIAGRAM



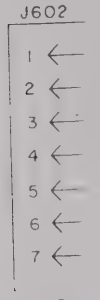
(19C321673, Sh. 2, Rev. 4)
(19C321673, Sh. 3, Rev. 4)

LEAD IDENTIFICATION
FOR Q601, Q602, & Q603

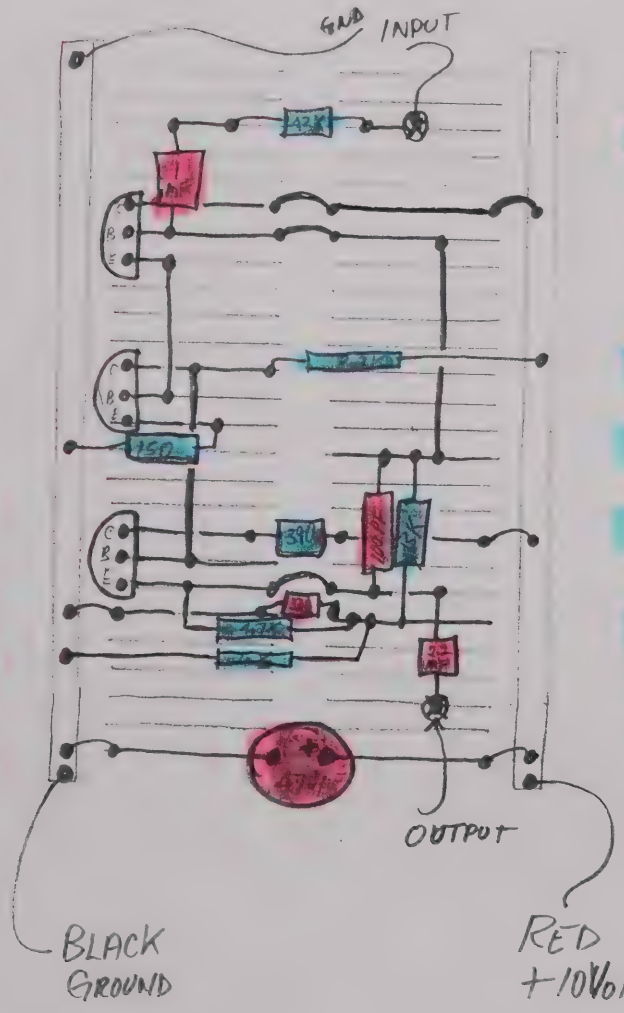




OSC - MU

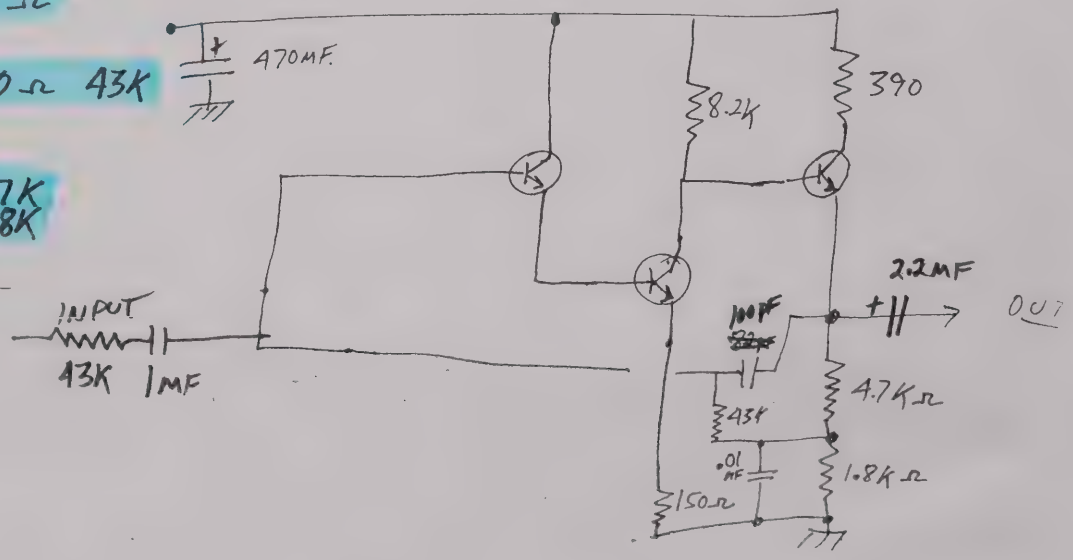


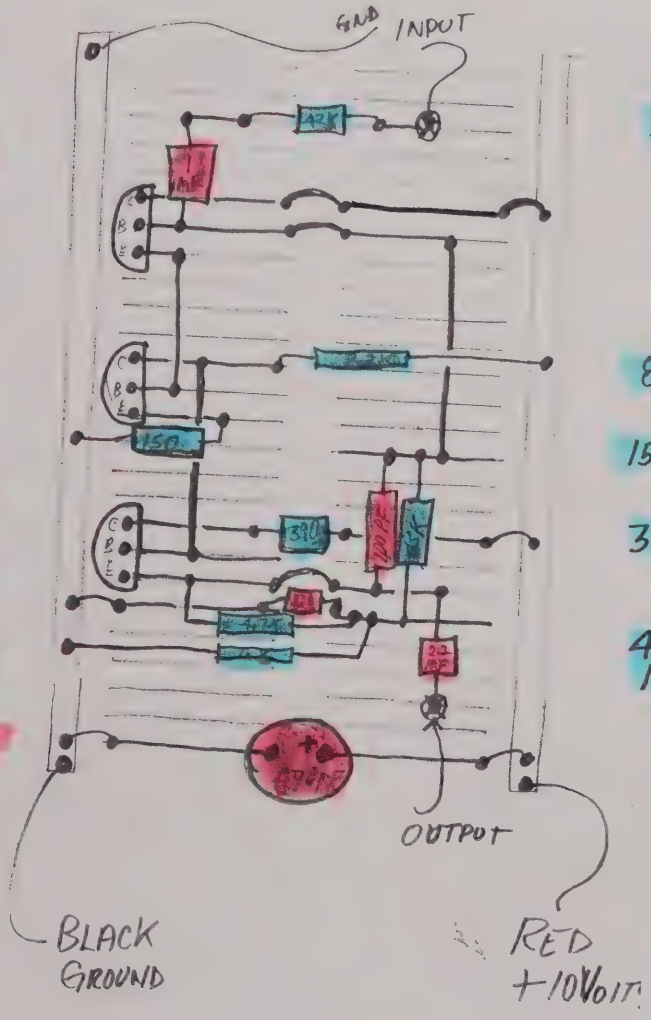
SAS



BOARD TOP VIEW

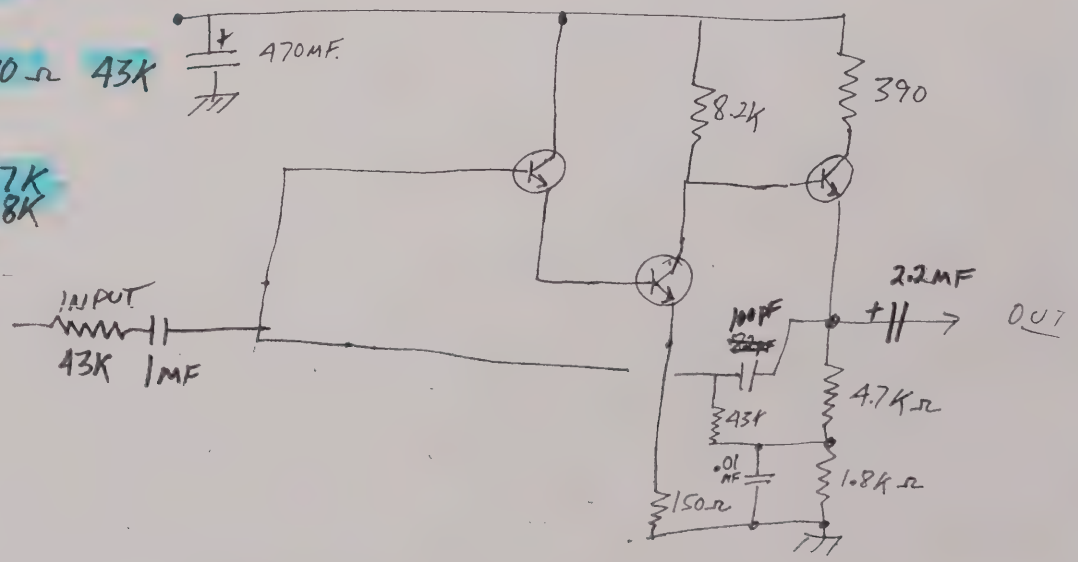
ALL 2N3904 TYPE





BOARD TOP VIEW

ALL 2N3904 TYPE



COPY

INSTRUCTION BOOK INDEX FOR MASTR CUSTOM MVP

MOBILE

PUBLICATION	LBI NUMBER	DATAFILE FOLDER NUMBER
Installation	LBI-30164	DF-9041
COMBINATION	LBI-30163	DF-9041
TRANSMITTER		
Description & Maintenance (Alignment)		
LB	LBI-30168	DF-3164
HB	LBI-30142	DF-3164
UHF	LBI-30155	DF-3164
EXCITER		
LB - 19D423355G1-G3	LBI-30045	DF-3165
HB - 19D423293G1, G2	LBI-30053	DF-3165
UHF - 19D423346G1, G2	LBI-30060	DF-3165
PA		
LB - 19D423926G2, 3, 4	LBI-30169	DF-3166
HB - 19D423927G1	LBI-30143	DF-3166
UHF - 19D423928G1, G3	LBI-30156	DF-3166
RECEIVER		
Description & Maintenance (Alignment)		
LB	LBI-30159	DF-1113
LB (With Noise Blanker)	LBI-30162	DF-1113
HB	LBI-30146	DF-1113
HB (With Noise Blanker)	LBI-30150	DF-1113
UHF	LBI-30152	DF-1113
RF Assembly & Mixer, IF Assembly		
LB - 19D416478G1-4 & 19C320094G1-G4	LBI-4989	DF-1107
LB(NB) 19D416478G1-4 & 19D416562G1-4	LBI-4991	DF-1107
HB - 19D416693G1, G2 & 19C320153G1	LBI-4980	DF-1107
HB(NB) 19D416693G1,G2 & 19D416662G1	LBI-4982	DF-1107
UHF (RF/Filter) 19D417075G9-G12 & 19B227059G1	LBI-30032	DF-1107
Oscillator/Multiplier Board		
LB - 19C321986G2-4	LBI-30160	DF-1106
HB - 19C321981G5, 6	LBI-30147	DF-1106
UHF - 19C321981G1-4	LBI-30147	DF-1106
IF-Detector 19C321662G1-G3	LBI-30049	DF-1105
System-Audio-Squelch Board 19C321920G1	LBI-30148	DF-4101
Carrier Defeat Timer 19C327047G1	LBI-30196	DF-8408
Channel Guard 19C321931G1-3	LBI-30195	DF-5047

DF-9041

STATIONS

AC Power Supply Option (19D423793G1, 2)	LBI-30166	DF-0073

TRANSMITTERS (See Mobile Listing)

RECEIVERS (See Mobile Listing)

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

DATAFILE

MASTR CUSTOM MVP COMBINATION

CUSTOM MVP MOBILES STATIONS

FOLDER NO. 9041
First Printing February 1976

MOBILE RADIO

AC POWER SUPPLY OPTION

COMBINATION NOMENCLATURE

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits	10th Digit
Mechanical Package	System Voltage	Power Output	Channel Spacing	Frequency Capacity	Number of Freq.	Options	Frequency Range	Oscillator Stability
C Front Mount	**T** +12 VDC (Negative Ground Only)	**4** 8-20 Watts	**4** 20 kHz	**A** Single Freq.	**A** 1 Freq. Tx 1 Freq. Rx	**S** Standard	**13** 30-36 MHz	**A** ±5 PPM
		5 21-40 Watts	**5** 25 kHz	**F** Multi-Freq.	**C** 2 Freq. Tx 2 Freq. Rx	**G** Channel Guard & UHS Receiver	**23** 36-42 MHz	**B** ±2 PPM
			6 30 kHz		**E** 3 Freq. Tx 3 Freq. Rx	**N** Noise Blanker	**33** 42-50 MHz	
					F 4 Freq. Tx 4 Freq. Rx	**P** UHS Receiver	**56** 138-155 MHz	
						U Channel Guard	**66** 150.8-174 MHz	
						W Channel Guard & Noise Blanker	**77** 406-420 MHz	
							88 450-470 MHz	
							89 470-494 MHz	
							91 494-512 MHz	

MASTR CUSTOM MVP

GENERAL ELECTRIC

19C321662G3 IFAS Use 19A423530G3 121-
19C321920G1 System Use 19C331617G1 140-

II-

19B227333G1 Power Cable 120"

19A423202G2 Ass'y Universal Use 19A423202G2 121-120

19C327167G1 2 Pair Ribbon 40'

38.950
38.950

G-15

× 19B 2=69 6 2 6 16 450-4

~~19B 2=69 6 2 6 2~~

-6 406-420
7 450-470

(R)

2616 438.950 Rx
267 438.950 Tx

G7

Tx+Rx 458.1125
3x+Rx 453.1125

G16

MOBILE RADIO

CUSTOM MVP

TWO-WAY FM RADIO COMBINATIONS

MAINTENANCE MANUAL LBI-30163B

DATAFILE FOLDER DF-9041

MOBILE RADIO

AC POWER SUPPLY OPTION

GENERAL ELECTRIC

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SYSTEM SPECIFICATIONS iii

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INITIAL ADJUSTMENT 1

OPERATION 3

MAINTENANCE 3

- Removing IC's 3
- Preventive Maintenance 4
- Test and Troubleshooting 4
- Disassembly 4
- Re-Installation 4
- Noise Suppression 4

SYSTEM INTERCONNECTION DIAGRAM (See System-Audio & Squelch Board Maintenance Manual)

MECHANICAL PARTS BREAKDOWN

- Main Chassis 9
- Receiver Assembly 10-12

ILLUSTRATIONS

1. Module Layout 2
2. Disassembly 4
3. Ignition Circuit with Noise Suppression Components 6
4. Generator Circuit with Noise Suppression Components 7

WARNING

Although the highest DC voltage in Custom MVP Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits. High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

SYSTEM SPECIFICATIONS*

BATTERY DRAIN	
Receiver	
Squelched	0.25 Amperes
Unsquelched	0.70 Amperes
Transmitter	5.5 Amperes at 13.8 VDC 2.0 Amperes at 13.8 VDC**
DIMENSIONS (H X W X D)	
Two-Way Radio	3.5" x 8.4" x 10.6"
AC Power Supply Option	3.5" x 8.4" x 10.6"
Mobile Speaker (less bracket)	5.1" x 5.1" x 2.8"
WEIGHT	
Two-Way Radio	8.0 Pounds
AC Power Supply Option	13.0 Pounds
Speaker	1.0 Pound, 8 ounces
TEMPERATURE RANGE	-30°C to +60°C (-22°F to +140°F)
DUTY CAPABILITY	
Intermittent	20% transmit, 100% receive

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

** Applies to Mobile Radio Combinations with 11th digit "L" only.

FCC FILING NUMBERS

TRANSMITTER	FREQUENCY RANGE (MHz)	FREQUENCY STABILITY	POWER OUTPUT
KT-133-A	30 - 50	5 PPM	25-Watt
KT-134-A	138 - 174	5 PPM	25-Watt
KT-135-A	406 - 420 450 - 512	5 PPM	20-Watt
KT-136-C	450 - 512	2 PPM	20-Watt
KT-142-A	450 -512	5 PPM	5-Watt

COMBINATION NOMENCLATURE (MEDIUM POWER)

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits	10th Digit
Mechanical Package	System Voltage	Power Output	Channel Spacing	Frequency Capacity	Number of Freq.	Options	Frequency Range	Oscillator Stability
C Front Mount	**T** +12 VDC (Negative Ground Only)	**4** 8-20 Watts	**4** 20 kHz	**A** Single Freq.	**A** 1 Freq. Tx 1 Freq. Rx	**S** Standard	**13** 30-36 MHz	**A** ±5 PPM
		5 21-40 Watts	**5** 25 kHz	**F** Multi-Freq.	**C** 2 Freq. Tx 2 Freq. Rx	**G** Channel Guard & UHS Receiver	**23** 36-42 MHz	**B** ±2 PPM
			6 30 kHz		**E** 3 Freq. Tx 3 Freq. Rx	**N** Noise Blanker	**33** 42-50 MHz	
					F 4 Freq. Tx 4 Freq. Rx	**P** UHS Receiver	**56** 138-155 MHz	
						U Channel Guard	**66** 150.8-174 MHz	
						W Channel Guard & Noise Blanker	**77** 406-420 MHz	
							88 450-470 MHz	
							89 470-494 MHz	
							91 494-512 MHz	

COMBINATION NOMENCLATURE (LOW POWER)

1st Digit	2nd Digit	3rd Digit	4th Digit	5th Digit	6th Digit	7th Digit	8th & 9th Digits	10th Digit	11th Digit
Mechanical Package	System Voltage	Power Output	Channel Spacing	Frequency Capacity	Number of Freq.	Options	Frequency Range	Oscillator Stability	PA Type
C Front Mount	**T** +12 VDC (Negative Ground Only)	**3** 1-7 Watts	**5** 25 kHz	**A** Single Freq.	**A** 1 Freq. Tx 1 Freq. Rx	**U** Channel Guard	**88** 450-470 MHz	**A** ±5 PPM	**L** Low Power
							89 470-494 MHz		
							91 494-512 MHz		

DESCRIPTION

The General Electric Custom MVP radio combinations are fully transistorized-utilizing both discrete components and integrated circuits (IC's) for high reliability. The standard combinations may be equipped with the following:

- One through four frequencies (low power combinations are single frequency only)
- Plug-in crystal oscillator modules for ±0.0005% oscillator stability. (±0.0002%* stability is available for special UHF transmit single frequency applications).
- Channel Guard (tone squelch)
- Noise Blanker* (not available at UHF)
- Ultra High Sensitivity Receiver* (not available at low band)

The combination consists of a front cap attached to a module mounting frame which slides into a box-type cover. The frame is retained in the cover by one wing nut at the rear of the unit. Threaded nut fasteners are provided in the sides of the cover to secure the mounting bracket. The radio is designed for front-mount installations in mobile applications.

The control panel located on the front cap of the radio contains an ON/OFF-VOLUME control, Squelch and Channel Guard monitor slide switch, an optional 4-frequency control switch and a red transmit Light Emitting Diode (LED) indicator.

No power supply is required since the highest supply voltage used in the radio is provided by the vehicle battery. The radio is designed for operation only in 12-Volt, negative ground vehicle systems.

The radio is of modular construction. All major modules and tuning adjustments are easily accessible. Removal of one wing nut at the rear allows the radio to be removed from the cover. (See Figure 1) The transmitter PA and filter boards, RF Assembly and Mixer-IF Board are accessible from the top of the radio. The exciter, receiver oscillator/multiplier, IF/Detector and multi-frequency* boards are accessible when the radio is turned over.

Removing two screws at each side of the front cap allows the front cap to be removed, exposing the radio System-Audio-Squelch (SAS) board and Channel Guard Board (when used). The fixed squelch control and Channel Guard modulation control are accessible through slots in the top edge of the front cap without removing the cap. Centralized metering jacks for the transmitter and receiver are provided for simplified alignment and troubleshooting.

TRANSMITTER

The transmitter consists of an exciter board and a power amplifier assembly. The power amplifier assembly is composed of the PA and low-pass filter. The antenna relay is mounted on the filter module.

RECEIVER

The receiver consists of an RF assembly, an Oscillator/multiplier assembly (Osc/Mult), mixer/IF assembly (MIF) and IF-Detector assembly (IFD). The audio and squelch circuitry for the receiver is located on the SAS board. In receivers with noise blankers, the noise blanker circuit replaces the standard MIF board. In UHS receivers, the pre-amplifier mounts in the area near the antenna input board.

SYSTEM-AUDIO-SQUELCH BOARD

The System-Audio-Squelch (SAS) board mounts on the front of the radio frame behind the front control panel. The board contains the 10-Volt regulator, transmitter and receiver control circuits and the receiver audio and squelch circuits. The optional Channel Guard board or Carrier Defeat Timer mounts along-side and connects to the SAS board by means of a harness. The optional Carrier Control Timer mounts directly to the SAS board.

AG POWER SUPPLY OPTION

To use theradio as a base station, an optional AC power supply is required. This supply is housed similar to the radio. The radio and power supply may be stacked or located side-by-side. A 15-inch 6-conductor cable connects between the power supply and the radio. A speaker and green POWER ON LED are provided with the supply.

INITIAL ADJUSTMENT

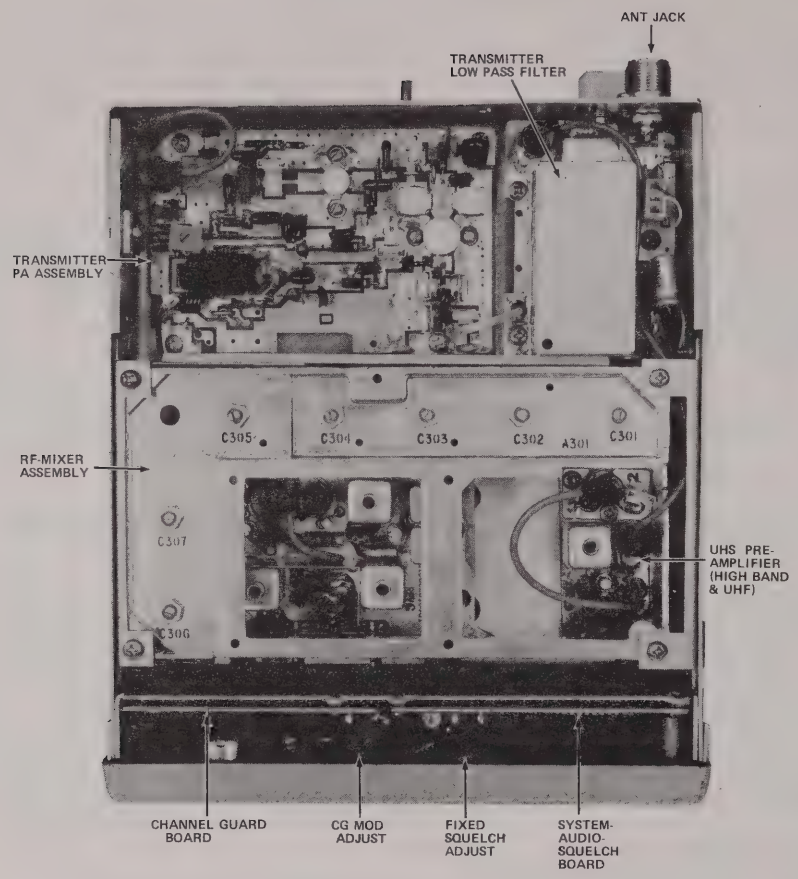
After the Custom MVP radio has been installed (as described in the Installation Manual), the following adjustments should be made by an electronics technician who holds a First or Second Class FCC Radiotelephone license. Make sure that a RADIO TRANSMITTER IDENTIFICATION FORM (FCC Form 452-C or General Electric Form NP270303) has been filled out and attached to the transmitter.

CAUTION

Before bench testing the Custom MVP Mobile Radio, be sure of the output voltage characteristic of your bench power supply.

* Does not apply to Combinations with 11th Digit "L" (low power)

TOP VIEW



BOTTOM VIEW

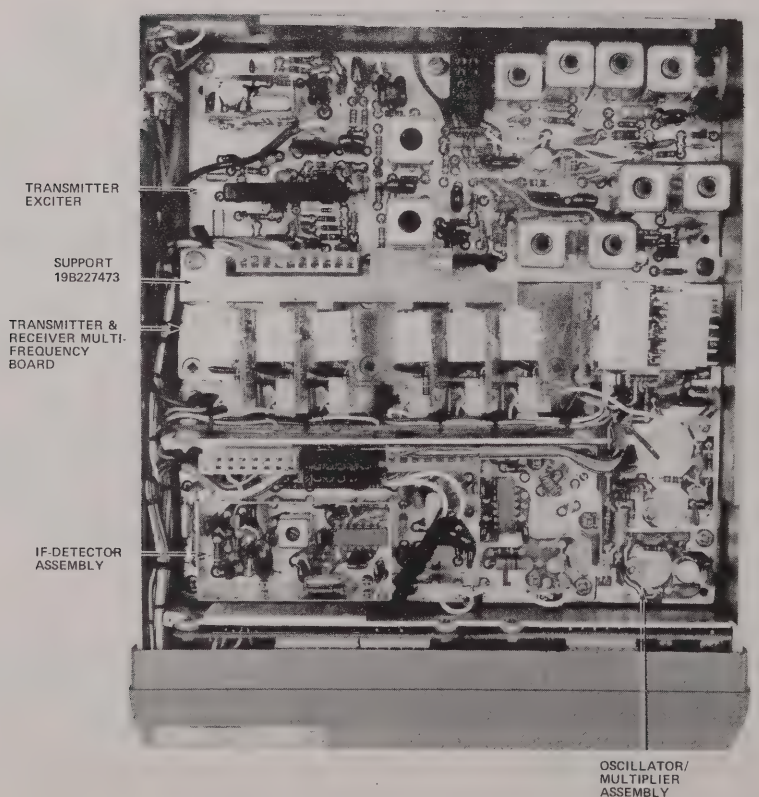


Figure 1 - Typical Custom MVP Module Layout

To protect the transmitter power output transistors from possible instant descruction, the following input voltages must not be exceeded:

Transmitter unkeyed: ..... 20 Volts

Transmitter keyed
(50 ohm resistive load): ..... 18 Volts

Transmitter keyed
(no load or non-resistive
load): ..... 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.8 VDC for loads up to 6 Amperes). Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery. It is recommended that the AC Power Supply (Option 1901) be used for bench testing the Custom MVP.

TRANSMITTER ADJUSTMENT

The adjustment for the transmitter includes measuring the forward and reflected power, and adjusting the antenna length for optimum ratio, then setting the transmitter to rated power output (or to the specific output or input which may be required by the FCC station authorization). Next, measuring the frequency and modulation and entering these measurements on the FCC-required station records. For the complete transmitter adjustment, refer to the ALIGNMENT PROCEDURE in the MAINTENANCE MANUAL for the transmitter.

RECEIVER ADJUSTMENT

The initial adjustment for the receiver includes tuning the input circuit to match the antenna. For the Receiver Initial Adjustment Procedure, refer to the FRONT END ALIGNMENT PROCEDURES in the MAINTENANCE MANUAL for the receiver.

OPERATION

Complete operating instructions for the Two-Way Radio are provided in the separate OPERATOR'S MANUAL. The basic procedures for receiving and transmitting messages follows:

TO RECEIVE A MESSAGE

1. Turn the radio on by turning the OFF-VOLUME control halfway to the right.

2. Slide the Squelch Switch on the Control panel to the TEST position and adjust the VOLUME control for a comfortable listening level.

The radio is now ready to receive messages from other radios in the system.

TO TRANSMIT A MESSAGE

1. Turn the radio on as directed in the "To Receive a Message" section.

2. Press the push-to-talk button on the microphone and speak across the face of the microphone in a normal voice. Release the button as soon as the message has been given. The red indicator light on the control panel will glow each time the microphone button is pressed, indicating that the transmitter is on the air. The receiver is muted whenever the transmitter is keyed.

MAINTENANCE

REMOVING IC's (and all other soldered-in components) can be easily accomplished by using a de-soldering tool such as a SOLDA-PULLT® or equivalent. To remove an IC, heat each lead separately on the solder side and remove the old solder with the de-soldering tool.

An alternate method is to use a special soldering tip that heats all of the pins simultaneously.

PREVENTIVE MAINTENANCE

To insure high operating efficiency and to prevent mechanical and electrical failures from interrupting system operations, routine checks should be made of all mechanical and electrical parts at regular intervals. This procedure should include the checks listed in the Table of Maintenance Checks.

TEST AND TROUBLESHOOTING PROCEDURES

The individual Maintenance Manual for the transmitter and receiver describe standard test procedures which the serviceman can use to compare the actual performance of the transmitter or receiver against the specifications of the unit when shipped from the factory. In addition, specific troubleshooting procedures are available to assist the serviceman in troubleshooting the transmitter and receiver.

RE-INSTALLATION

If the mobile combination is ever moved to a different vehicle, always check the battery polarity of the new system.

NOISE SUPPRESSION

After completing the initial adjustment of the transmitter and receiver, the serviceman should determine whether additional noise suppression is required. The following information should assist the serviceman in identifying and eliminating undesirable noise interference.

DISASSEMBLY

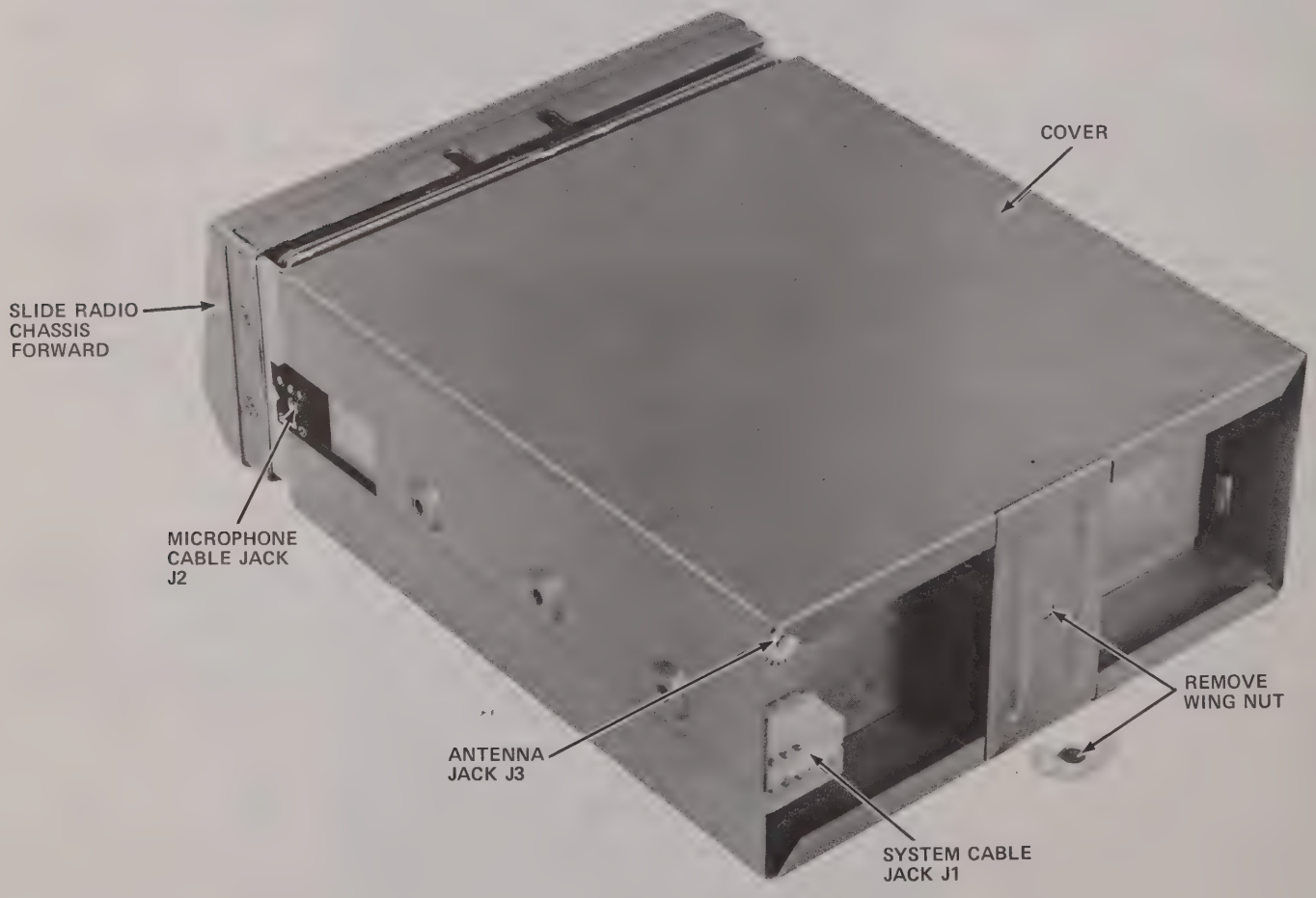


Figure 2 - Disassembly Procedure

MAINTENANCE CHECKS	INTERVAL	
	6 Months	As Required
CONNECTIONS - Ground connections and connections to the voltage source should be periodically checked for tightness. Loose or poor connections to the power source will cause excessive voltage drops and faulty operation. When ground connections are not made directly to the battery, the connection from the battery to vehicle chassis must be checked for low impedance. A high impedance may cause excessive voltage drop and alternator noise problems.	X	
ELECTRICAL SYSTEM - Check the voltage regulator and alternator or generator periodically to keep the electrical system within safe and economical operating limits. Over-voltage is indicated when the battery loses water rapidly. Usage of 1 or 2 ounces of water per cell per week is acceptable for batteries in continuous operation. A weak battery will often cause excessive noise or faulty operation.		X
MECHANICAL INSPECTION - Since mobile units are subject to constant shock and vibration, check for loose plugs, nuts, screws and parts to make sure that nothing is working loose.	X	
ANTENNA - The antenna, antenna base and all contacts should be kept clean and free from dirt or corrosion. If the antenna or its base should become coated or poorly grounded, loss of radiation and a weak signal will result.	X	
ALIGNMENT - The transmitter and receiver meter readings should be checked periodically, and the alignment "touched up" when necessary. Refer to the applicable ALIGNMENT PROCEDURE and troubleshooting sheet for typical voltage readings.		X
FREQUENCY CHECK - Check transmitter frequency and deviation as required by FCC. Normally, these checks are made when the unit is first put into operation, after the first six months and once a year thereafter.		X

Ignition Noise

Ignition noise sounds like a "popping" sound in the speaker, whose frequency varies with engine speed while a weak signal is being received. This type of interference is generated by the spark plugs, distributor and any poor connections in the high-voltage system which might cause arcing. Ignition noise may be identified by noting that the noise disappears as soon as the ignition switch is turned off.

1. If the vehicle does not have a resistance lead from the coil to the center of the distributor cap, disconnect the lead at the distributor and cut the lead so that a Cable-Type Suppressor may be inserted in it close to the distributor. Screw the cut ends of the lead into the suppressor.

NOTE

A resistance lead operates as a very effective noise suppressor as long as there are no breaks anywhere along its length. Never cut a resistance lead to insert a suppressor. A loose knot is often tied in the lead to prevent excess flexing, which might break the conductor.

2. Check to see that:

   -- the distributor points and condenser are in good condition.

   -- the high-voltage leads from the distributor are not broken and are making good contact at each end.

   -- the spark plugs have clean, dry insulators and their electrodes are clean and properly adjusted.

   -- the timing has been properly adjusted.

3. Use a 0.5-mFd by-pass capacitor to by-pass the battery lead to the ignition coil. Mount the capacitor under a screw which will provide a good ground and connect the capacitor lead to the terminal of the coil which is connected to the ignition.

4. Remove the ignition coil and its mounting bracket. Clean paint from coil (where the bracket mounts), from the bracket and from the engine block. Remount the coil so as to obtain a good ground for the coil case.

5. If the vehicle has been driven 30,000 or 40,000 miles or more, the cap and rotor of the distributor will probably need replacing. This will not only reduce ignition noise, but also improve the overall performance of the engine.

6. High-voltage ignition wires can become capacitively coupled to the low-voltage systems, causing ignition noise to appear in the low-voltage system. This coupling can be minimized by separating the high- and low-voltage leads, or if necessary, separately shielding the leads.

7. If one of the ignition leads happens to have the critical length for radiating at the receiver's frequency, the noise can be reduced by changing the length of the lead. A noise source of this type is not common and can only be found by using a noise meter or by trial and error.

8. If the preceding steps fail to reduce ignition noise to a satisfactory level, it may be necessary to install resistance-type spark plugs, individual suppressors on each spark plug, or a shielded ignition wire harness.

Alternator Noise

Alternator noise shows up as a high-pitched "whine", whose pitch varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise on the receiver. Alternator noise will continue as long as the engine turns, lowering in pitch as the engine slows down.

It may be necessary to install a coaxial type, 0.5 mFd filter capacitor from the ungrounded alternator terminal to ground.

CAUTION

Do not install this capacitor on alternators that are equipped with a factory-supplied capacitor for protecting the rectifiers and suppressing noise.

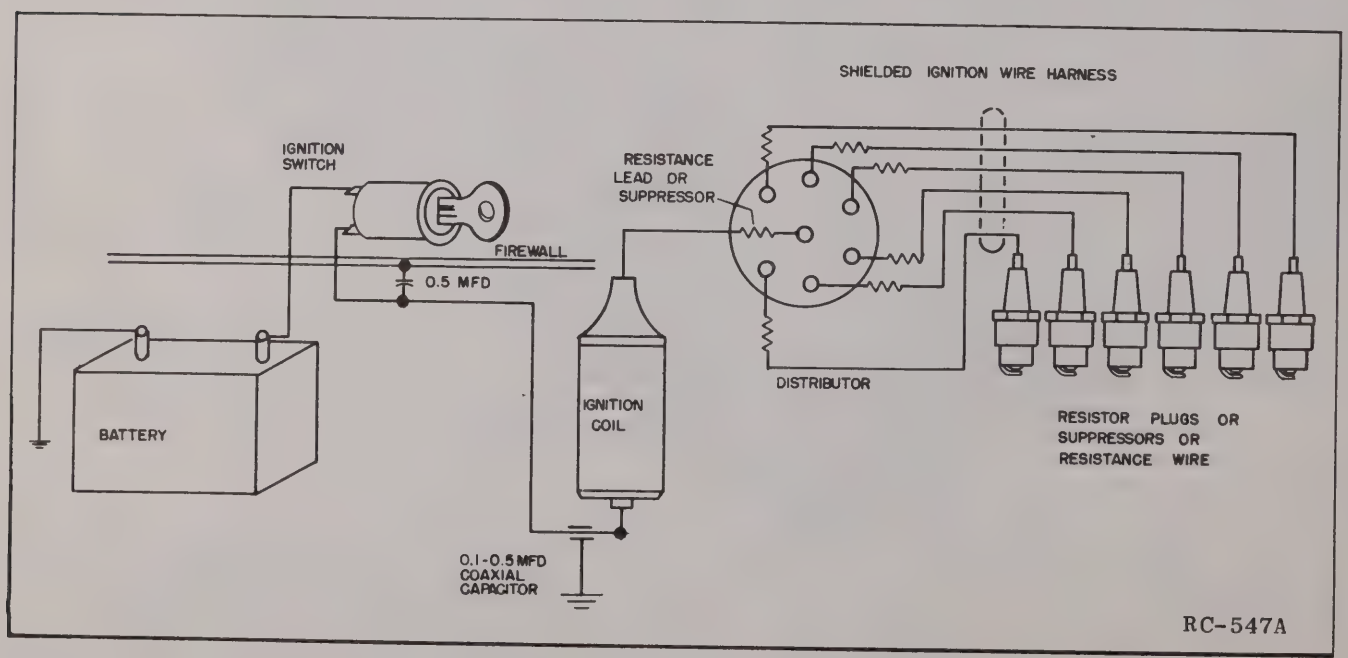


Figure 3 - Ignition Circuit with Noise Suppression Components

NOTE

It is recommended that the radio power leads be connected directly to the battery, since alternator noise levels are lowest at the battery. If ignition switch control is required, a special lead is required (refer to Installation Instructions). The high current transmitter should always be connected to the battery.

Generator Noise

Generator noise shows up as a high-pitched "whine", whose pitch varies with engine speed. To check for this type of noise, run the engine at a moderate speed and then shut off the engine, while listening to the noise on the receiver. Generator noise will continue as long as the engine turns, lowering in pitch as the engine slows down.

By-pass the armature terminal on the generator to ground with a 0.5 mFd, 40 or 50-amp coaxial capacitor. Be sure to scrape the area where the capacitor is to be mounted, so that its case will be well grounded.

CAUTION

Do not by-pass the field terminal (F), as this will damage the voltage regulator contacts.

Generator Regulator Noise

Generator regulator noise shows up as a "raspy" sound which is generated by the contacts in the regulator and radiated by the leads coming out to the regulator. If suppression of regulator noise is necessary, connect a 5-ohm resistor in series with a .002-mFd capacitor from the field terminal (F) of the regulator to ground. If possible, these components should be mounted inside regulator case. The battery terminal (BAT) and armature terminal (ARM) can be by-passed to ground with 0.5-mFd capacitors.

CAUTION

If the regulator is opened to install the capacitor or resistor, remember that one wrong connection or shorted wire can damage the regulator or generator.

Gauge noise produces a "hissing" or "crackling" sound. Tapping the face of each gauge while the engine is running usually shows up which gauge is at fault. By-pass the gauge lead to ground with a 0.5-mFd capacitor, connected close to the sensing element.

Static and Arcing Noise

The following suggestions may help to cure other unusual types of interference:

1. Use bonding braid to electrically bond the hood and each corner of the engine block to the vehicle's frame. Scrape paint and dirt from bonding points to obtain a good ground.
2. Treat noisy tires with anti-static powder.
3. Use front-wheel static collectors for irregulator "popping" noise which disappears when the brakes are applied.
4. Use heavily graphited penetrating oil on the exhaust pipe and muffler supports if they are producing noise.

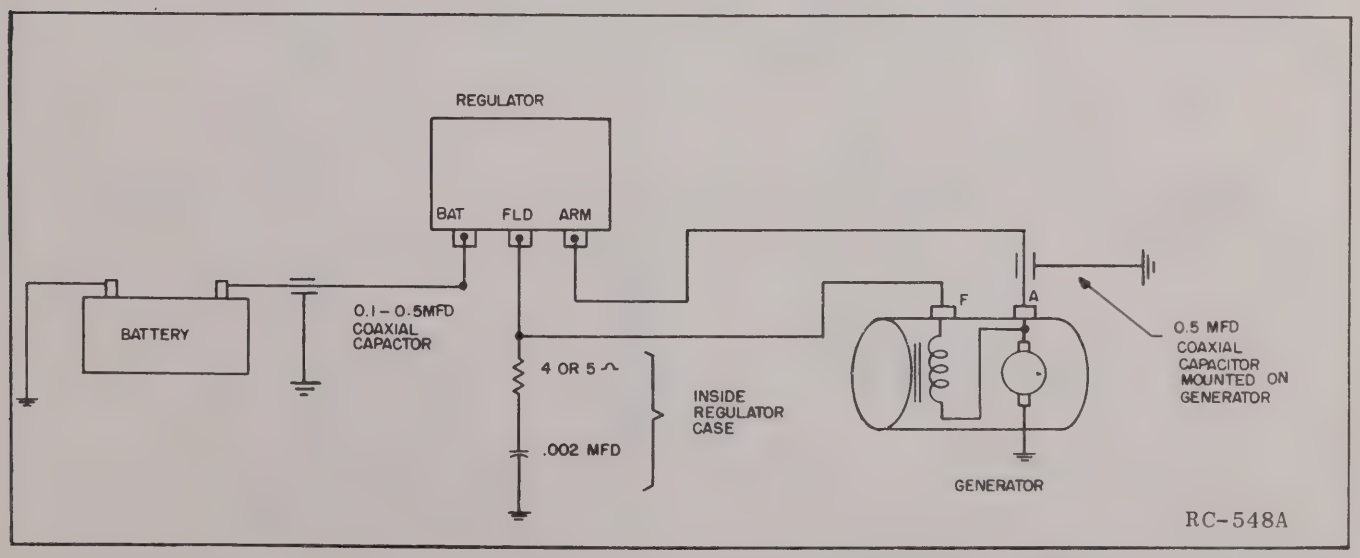
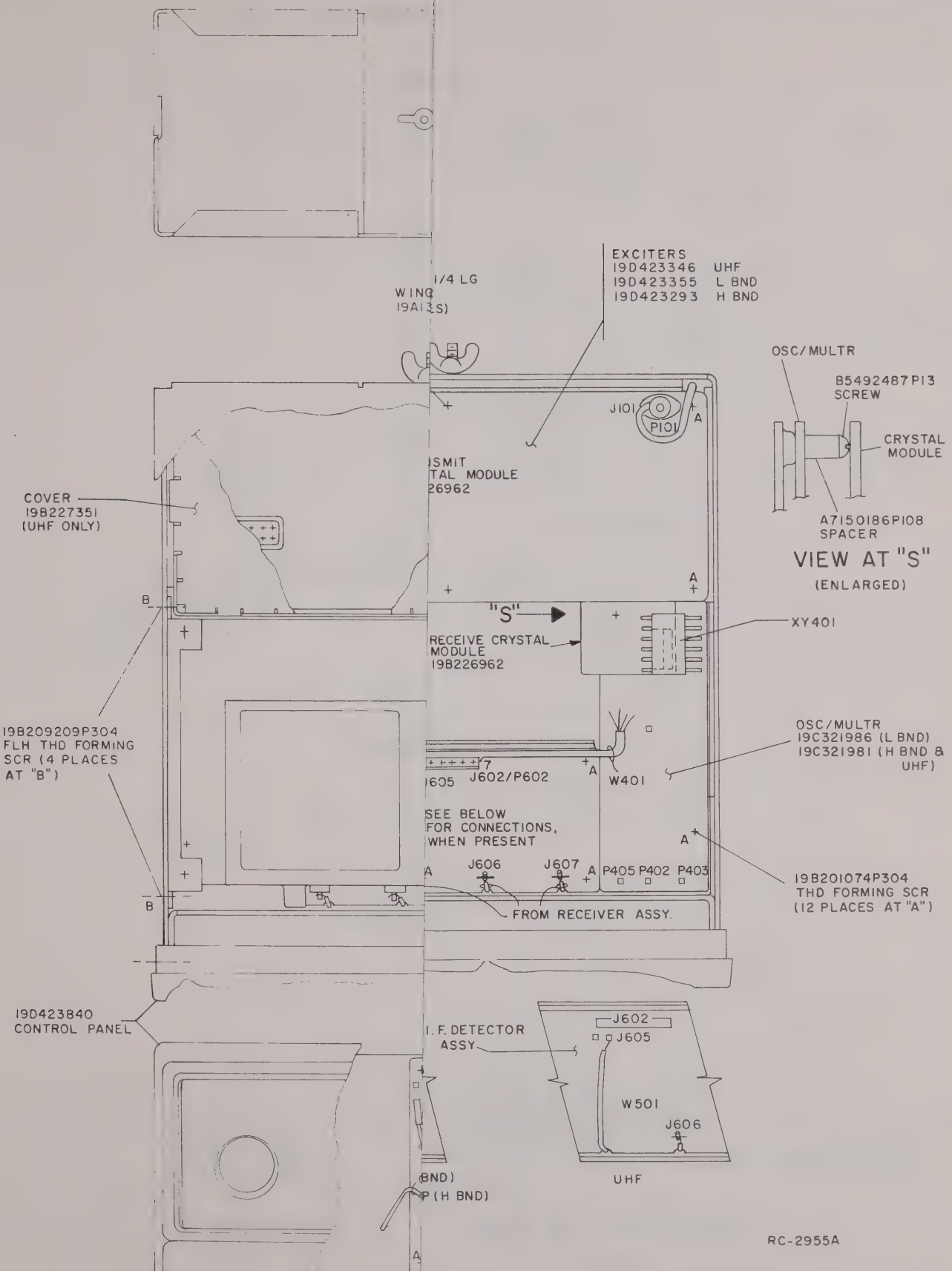
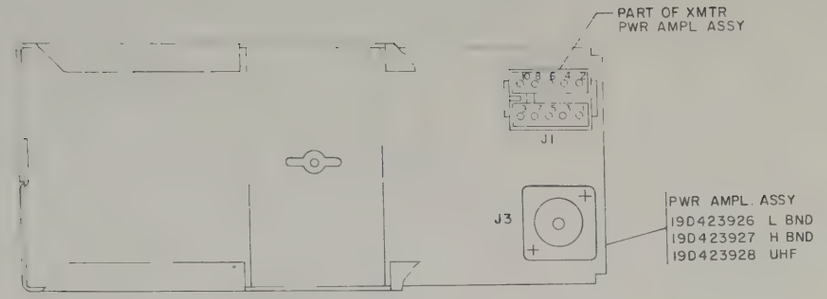


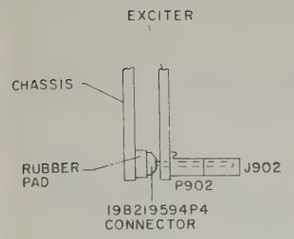
Figure 4 - Generator Circuit with Noise Suppression Components



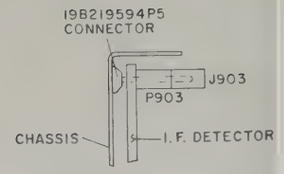
MECHANICAL PARTS BREAKDOWN

CUSTOM MVP RADIO CHASSIS

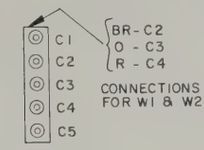




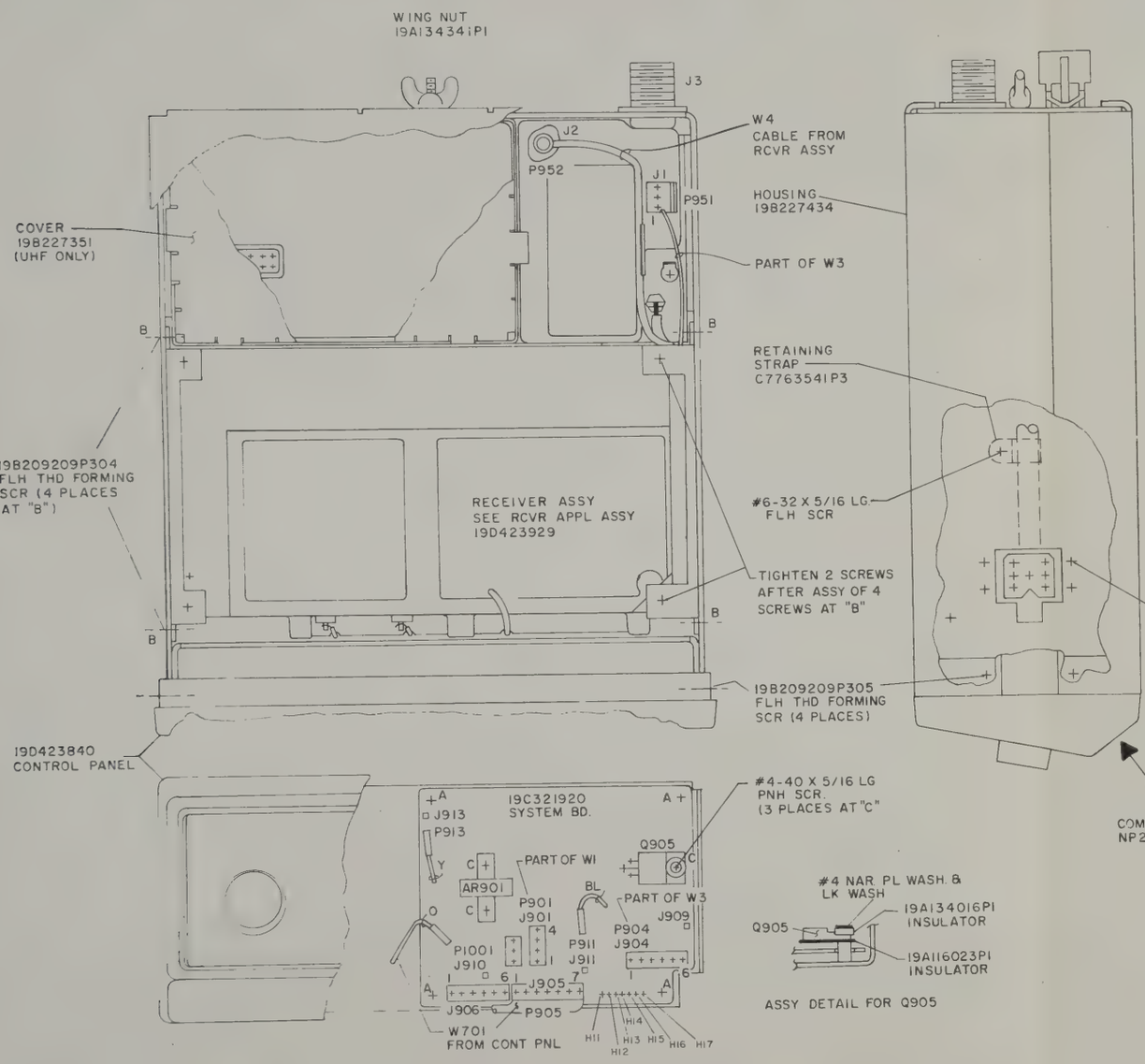
VIEW AT "C"



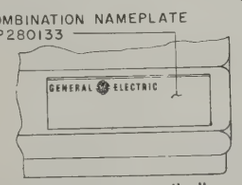
VIEW AT "D"



VIEW-Z



ASSY DETAIL FOR Q905



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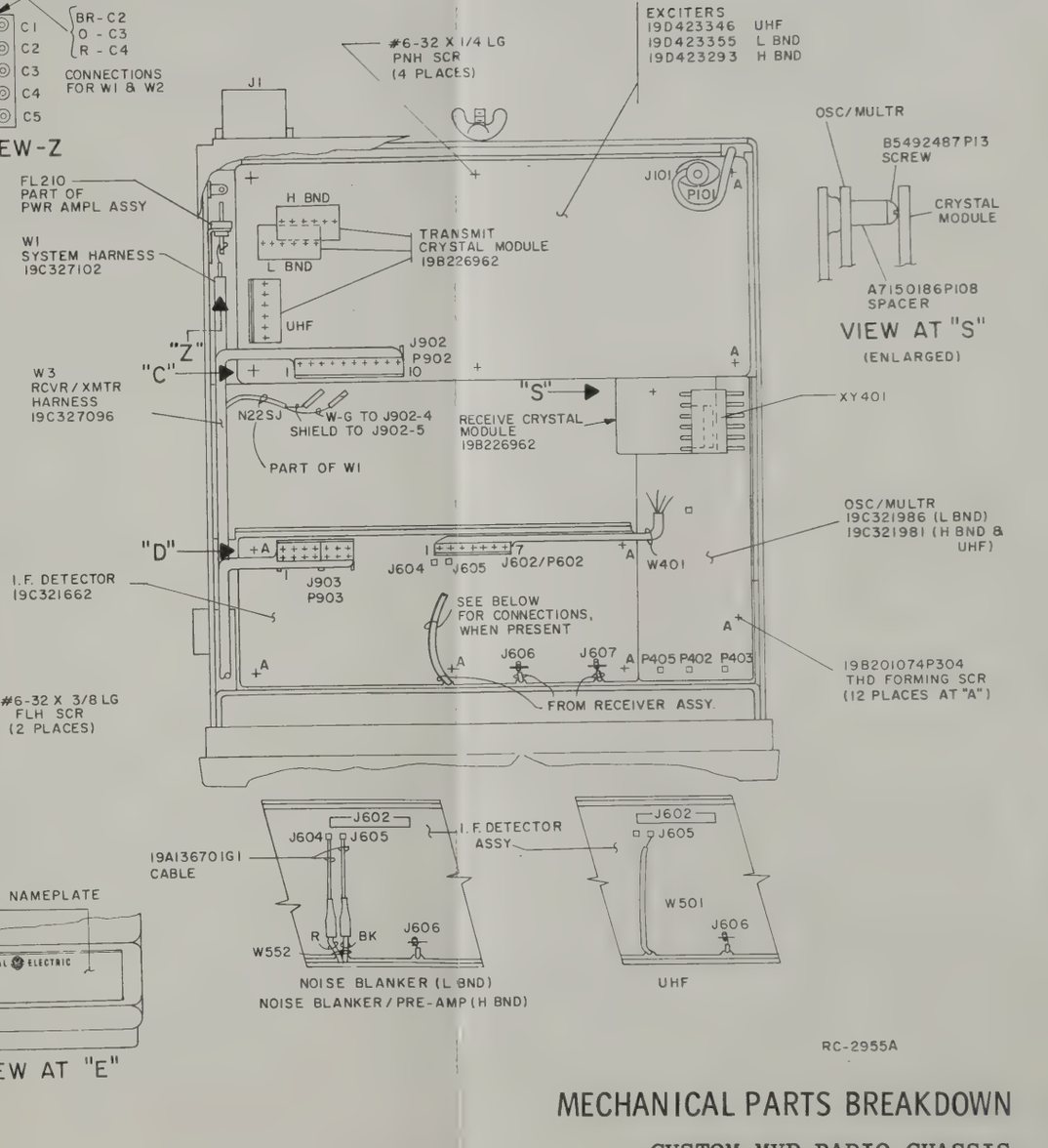
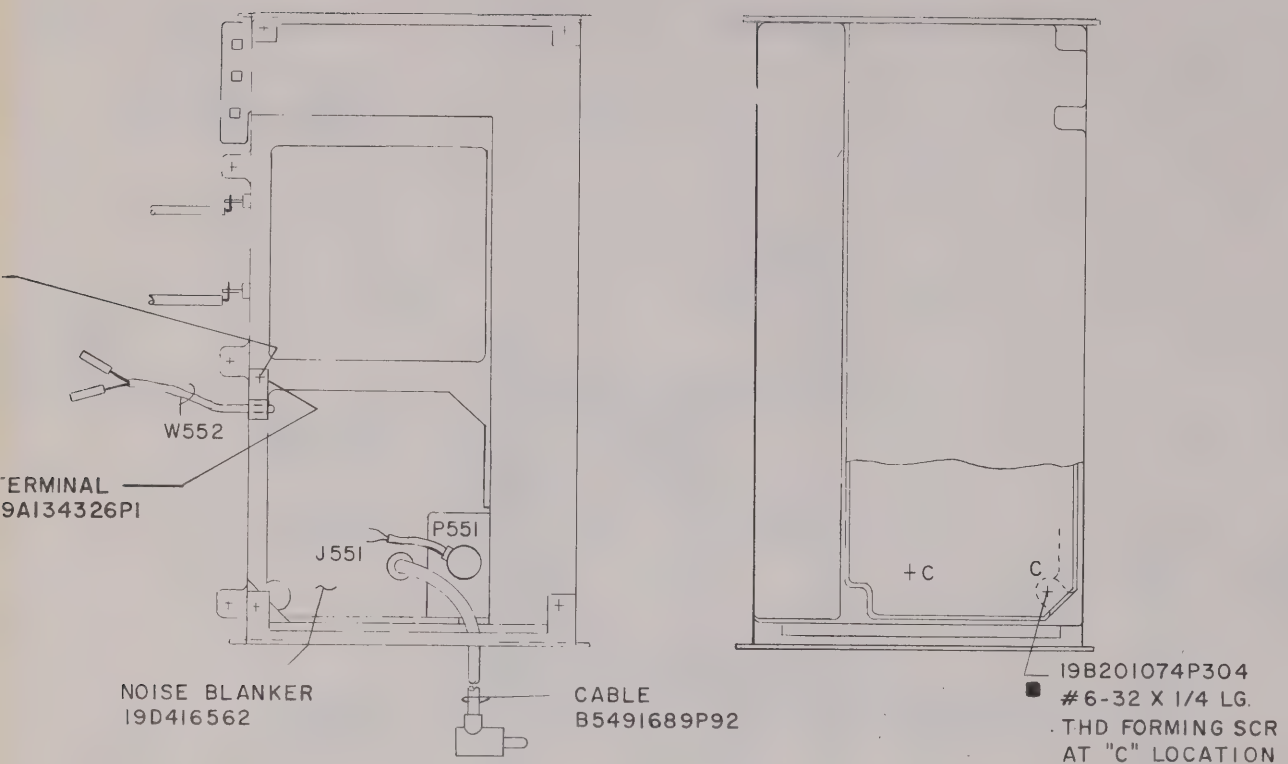


VIEW AT "S" (ENLARGED)

RC-2955A

(19D423962, Sh. 1, Rev. 8)
(19D423962, Sh. 2, Rev. 7)



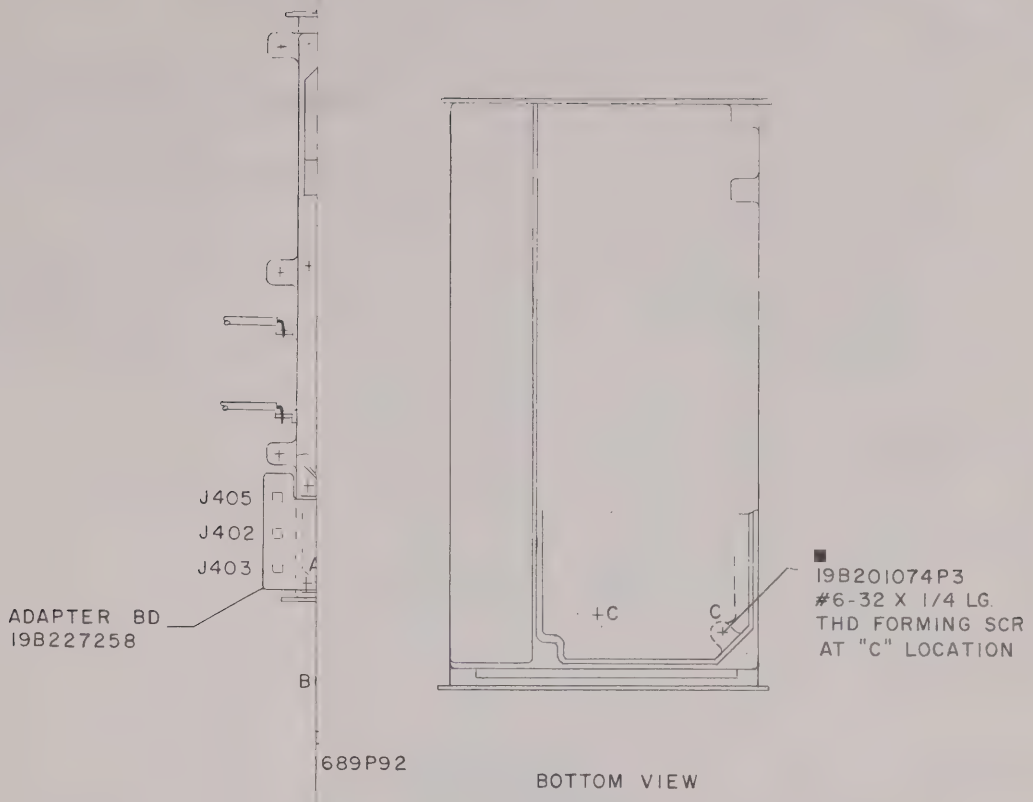
NOISE BLANKER FOR LOW BAND

NOTES.

1. ■ PART OF HARDWARE LIST 19A136613G2 CALLED FOR ON ADAPTER BDS.

(1) ASSEMBLY OF LOW BAND RECEIVER.

(4) ASSEMBLY OF LOW BAND NOISE BLANKER



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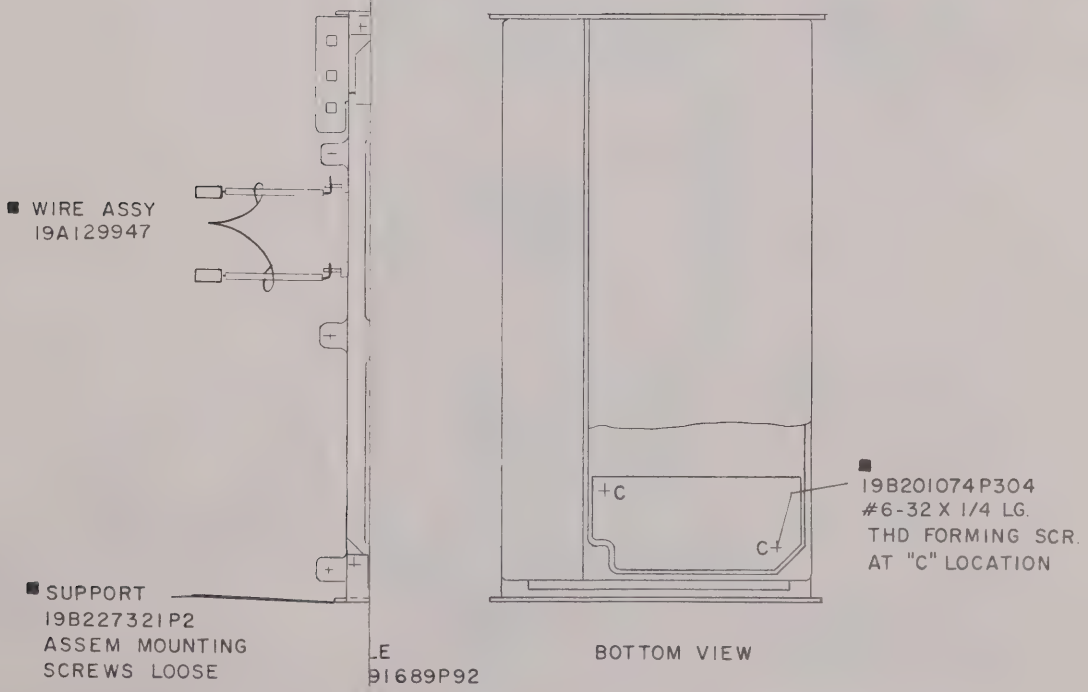
R-PRE AMP HIGH BAND



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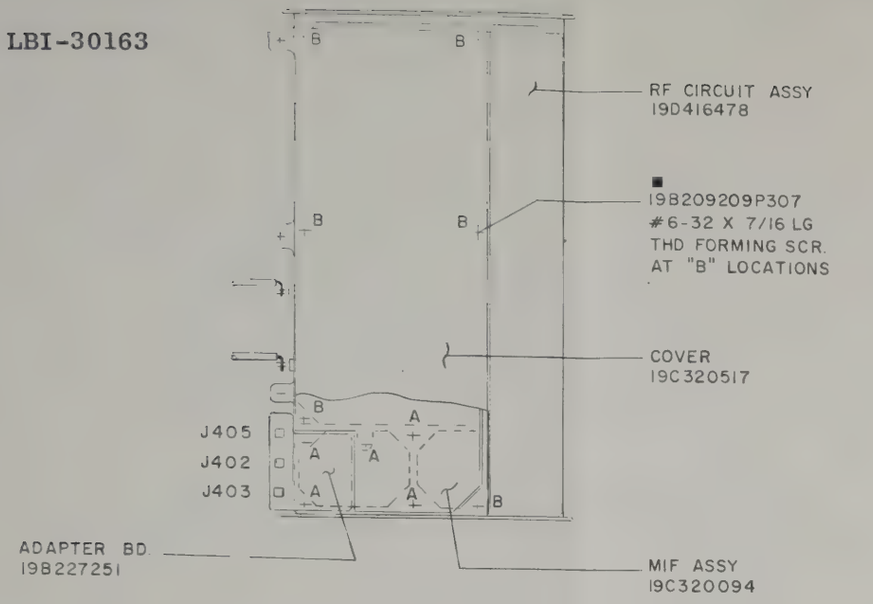
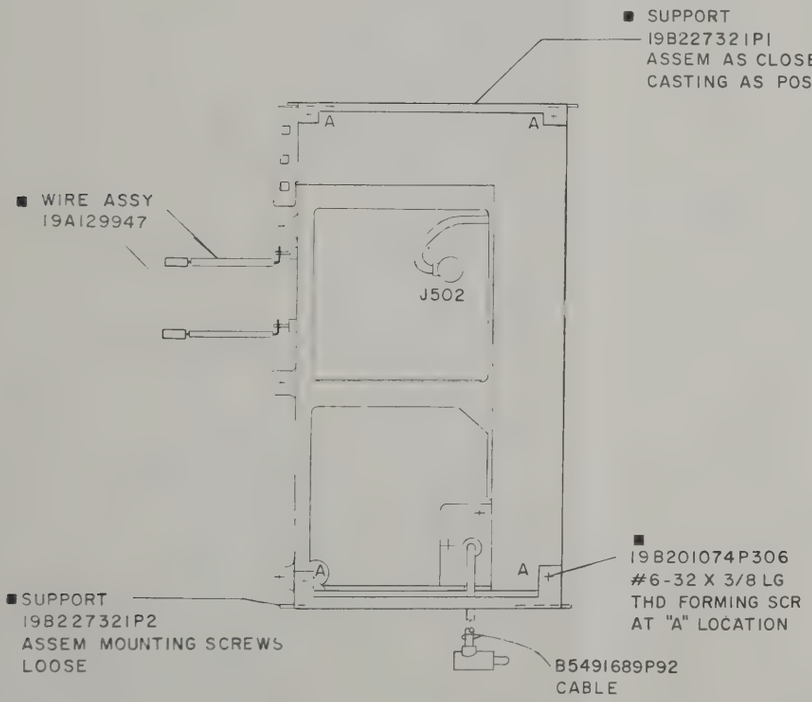
MP HIGH BAND

MECHANICAL PARTS BREAKDOWN

138—174 MHz RECEIVER

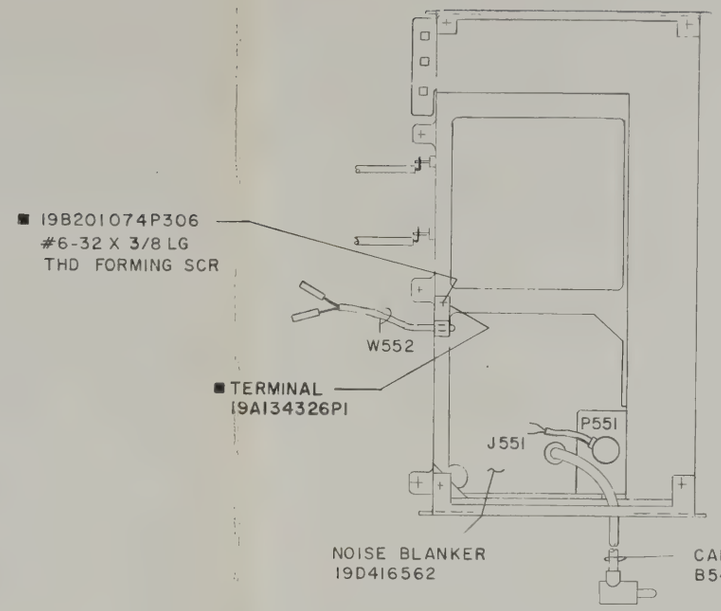


BOTTOM VIEW



RECEIVER LOW BAND

TOP VIEW



TOP VIEW

BOTTOM VIEW

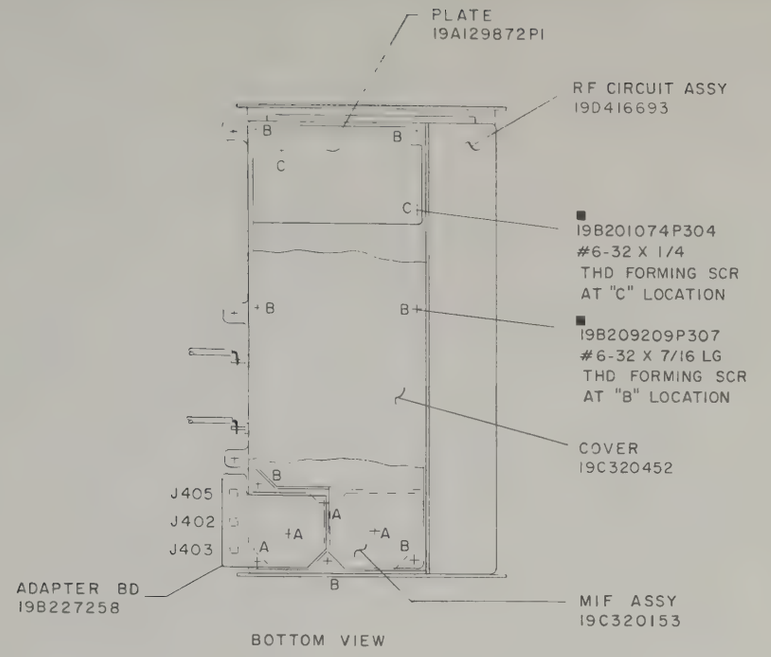
NOISE BLANKER FOR LOW BAND

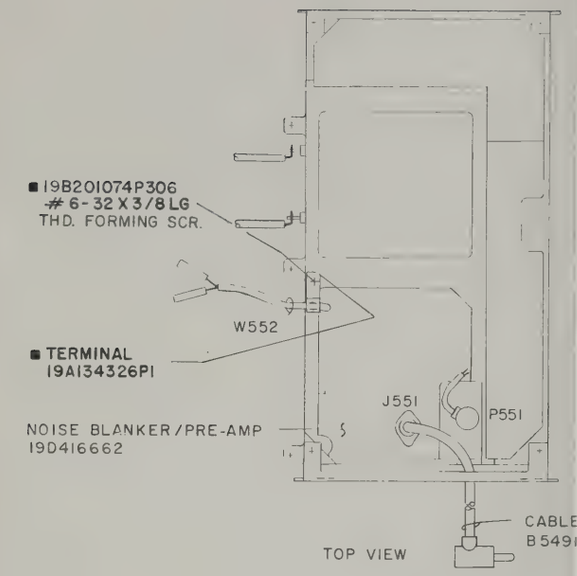
NOTES.
1. ■ PART OF HARDWARE LIST 19A136613G2 CALLED FOR ON ADAPTER BDS.

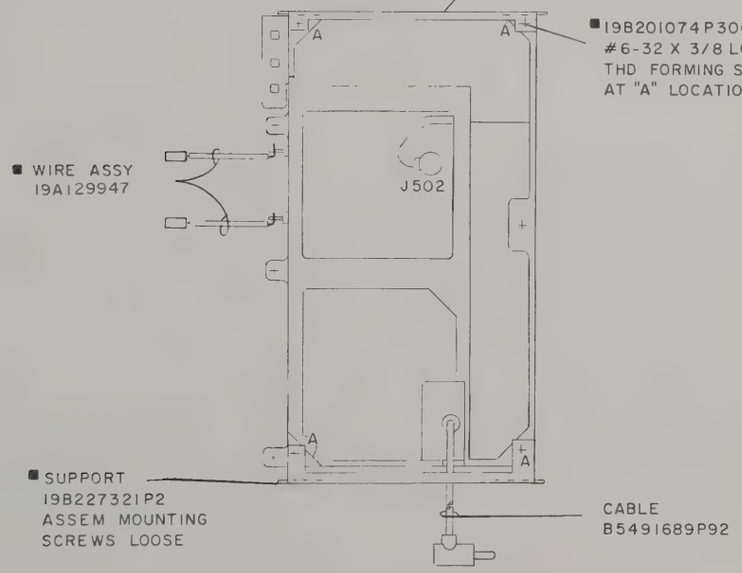
(1) ASSEMBLY OF LOW BAND RECEIVER.

(4) ASSEMBLY OF LOW BAND NOISE BLANKER

(19D423929, Sh. 1, Rev. 5)







RECEIVER HIGH BAND

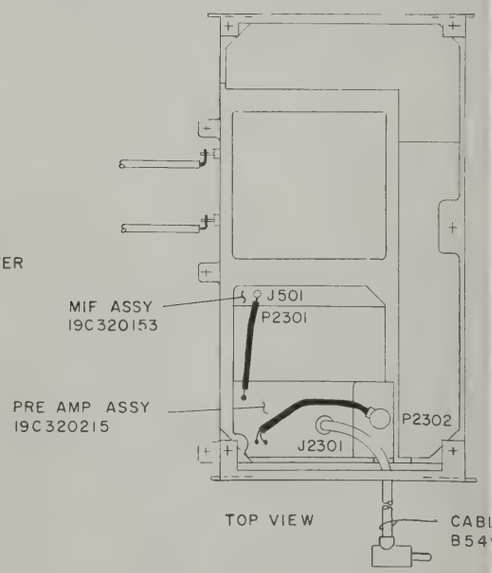
TOP VIEW

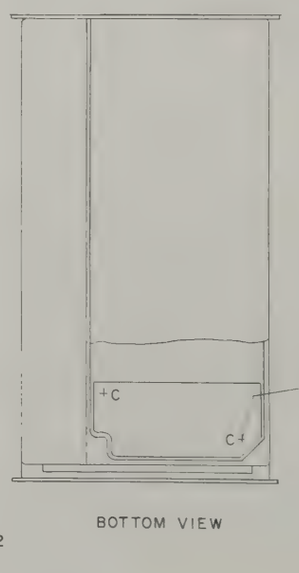
(2) ASSEMBLY OF HIGH BAND RECEIVER

(5) ASSEMBLY OF HIGH BAND NOISE BLANKER

(6) ASSEMBLY OF HIGH BAND PRE-AMP

NOISE BLANKER-PRE AMP HIGH BAND





PRE-AMP HIGH BAND

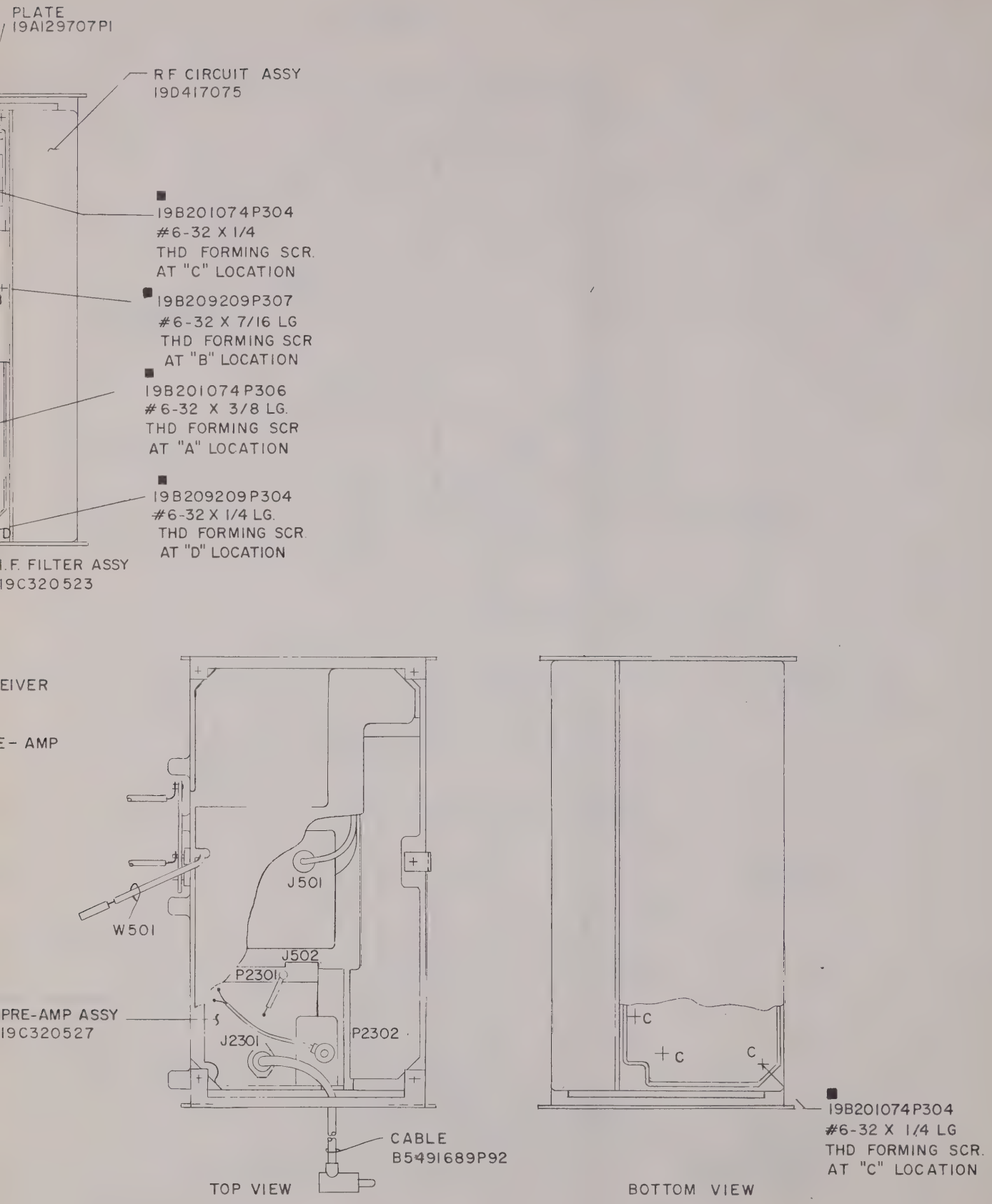


PLATE
19A129707P1
RF CIRCUIT ASSY
19D417075
19B201074P304
#6-32 X 1/4
THD FORMING SCR.
AT "C" LOCATION
19B209209P307
#6-32 X 7/16 LG
THD FORMING SCR
AT "B" LOCATION
19B201074P306
#6-32 X 3/8 LG.
THD FORMING SCR
AT "A" LOCATION
19B209209P304
#6-32 X 1/4 LG.
THD FORMING SCR.
AT "D" LOCATION
I.F. FILTER ASSY
19C320523
EIVER
E- AMP
PRE-AMP ASSY
19C320527
W501
J501
J502
P2301
J2301
P2302
CABLE
B5491689P92
TOP VIEW
C
C
C
19B201074P304
#6-32 X 1/4 LG
THD FORMING SCR.
AT "C" LOCATION
BOTTOM VIEW

PRE AMP UHF

ORDERING SERVICE PARTS

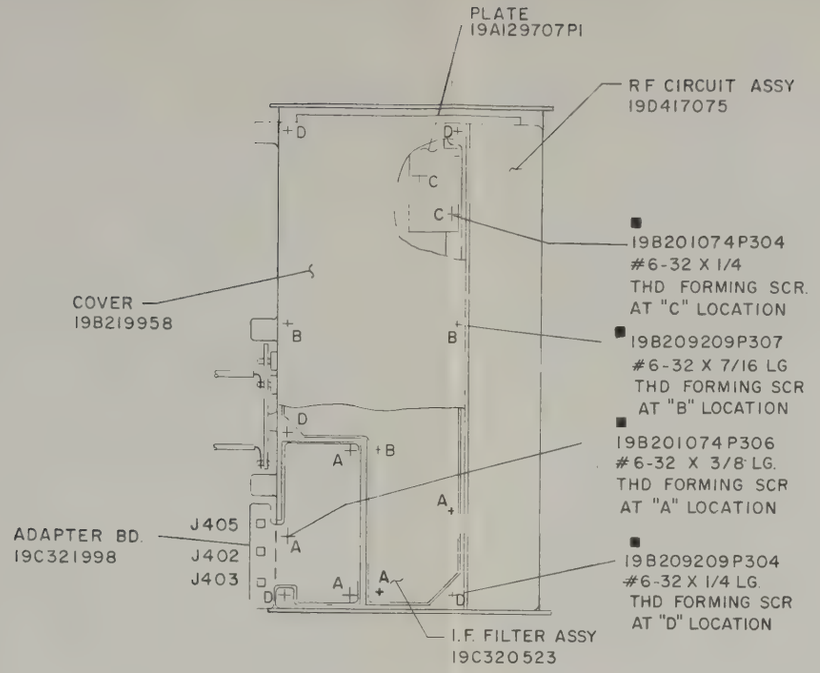
Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

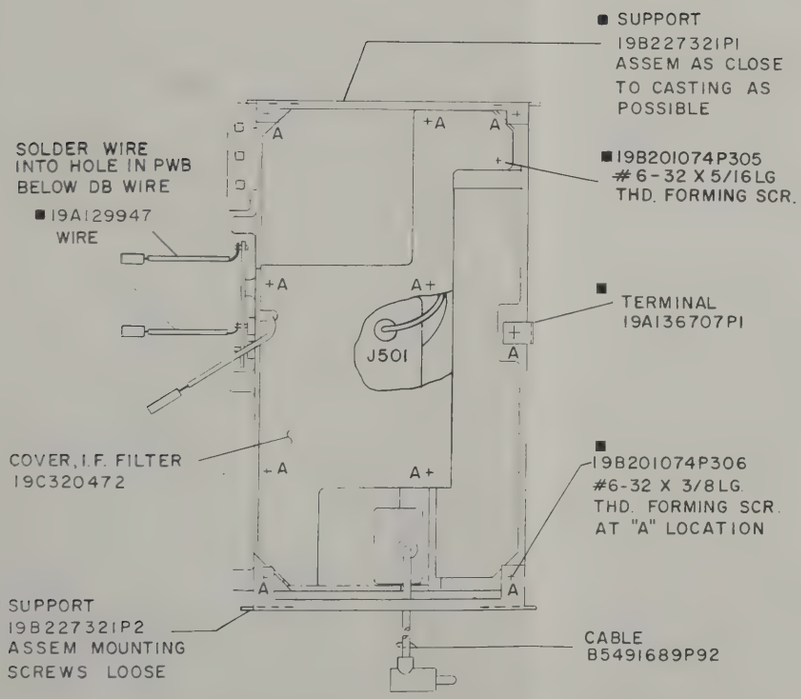
1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.



BOTTOM VIEW

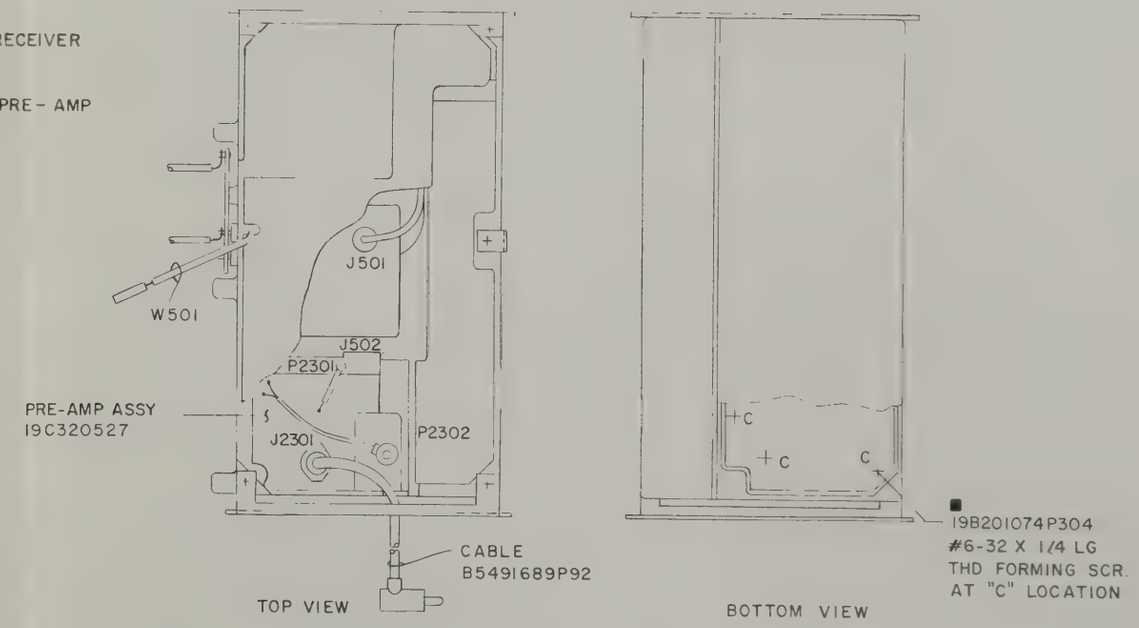


RECEIVER UHF I.F. FILTER

TOP VIEW

(3) ASSEMBLY OF UHF RECEIVER

(7) ASSEMBLY OF UHF PRE-AMP



TOP VIEW

BOTTOM VIEW

PRE AMP UHF

(19D423929, Sh. 3, Rev. 4)

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A

ECP-824

MOBILE RADIO

MASTR CUSTOM MVP
MAINTENANCE MANUAL

SYSTEM-AUDIO-SQUELCH BOARD, CONTROL PANEL, MULTI-FREQ. KIT

SPECIFICATIONS *

INPUT VOLTAGE	13.0 Volts DC ±20% (RX) 13.2 Volts DC ±20% (TX)
OUTPUT VOLTAGE	Regulated 10 Volts DC ±0.1 VDC at 0.1 to 0.5 Amperes
MAXIMUM CURRENT DRAIN (at 13.8 VDC)	0.25 Amperes (Squelched) 0.70 Amperes (Unsquelched)
AUDIO OUTPUT	3.0 Watts at less than 5% Distortion

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications

GENERAL ELECTRIC

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2 PPM Oscillator Board 19C327107G1 8

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WARNING

Although the highest DC voltage in MASTR Custom MVP Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits! High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

DESCRIPTION

The System-Audio-Squelch Board for the MASTR Custom MVP radio mounts on the front of the system frame behind the front control panel assembly. Molex connectors are provided on the board to provide interconnection with other modules and options. The microphone jack connects into the system harness between the System-Audio-Squelch (SAS) Board and the system connector (J1) at the rear of the radio. The Carrier Control Timer (option 1907) connects directly to the SAS board. The Channel Guard board or Carrier Defeat Timer (Option 1908) connects to the SAS board be means of a harness.

The SAS board contains a hybrid 10-Volt Regulator IC, a hybrid Squelch Module IC and a monolithic 3-Watt audio amplifier circuit. An active filter de-emphasis network is also provided in the audio circuit.

The Control Panel assembly is located on the front cap of the radio. An ON-OFF-VOLUME control, a squelch and Channel Guard MONITOR slide switch, a red transmit indicator Light Emitting Diode (LED), and a frequency control switch (on multi-frequency radios) are provided on the Control Panel. A harness, terminated with a 7-pin connector, connects these controls to the System-Audio-Squelch Board.

CIRCUIT ANALYSIS

10-Volt Regulator IC

The 10-Volt Regulator IC contains the following circuits:

- 10-Volt Regulator Reference Amplifiers
- Receiver Muting and Delay
- Transmitter Keying and Delay
- Receiver Oscillator Control
- Transmitter Disable

The 10-Volt Regulator includes regulator amplifier transistors in the IC (U902) and regulator pass transistor Q905. The regulator circuit provides a closely-controlled supply voltage for the transmitter exciter and the receiver, as well as for Channel Guard and Carrier Control Timer options when used.

Turning on the radio with ON-OFF switch S701 applies voltage (A+) from the battery (in mobile combinations) or the AC power supply (when the station option is used) to pin 1 of IC U902. The regulator amplifier output at pin 2 of U902 is applied to the base of Q905, causing Q905 to conduct. The voltage at the collector of Q905 and pin 3 of U902 is the regulated 10 Volts output.

Receive Function

When the radio is in the receive mode, the transmitter oscillator control switch in the regulator IC U902 is turned off and the receiver oscillator control switch is turned on. The 10-Volt output of this switch is connected through pin 7 of U902 to the receiver oscillator control circuits.

VOLUME/SQUELCH HI from the IF/DETECT module is connected via the VOLUME control (R701) to the audio amplifier on the SAS board. The active filter (Q904) and de-emphasis network provide a 6 dB/Octave frequency response. The audio from the filter is applied to the monolithic amplifier AR901. This amplifier is supplied in a modified 16 lead quad-in-line package with wing-tab heat sinks. The amplifier provides 3-Watts output to the speaker.

When Channel Guard is used, the filter located on the Channel Guard module connects in series with the VOLUME control arm (by removing the jumper between H1 and H2 on the SAS board) and the input to the de-emphasis network. The Channel Guard filter provides a minimum of 17 dB attenuation of the CG tone frequencies.

Squelch Control Circuit

The hybrid squelch IC (U901) uses a custom flip-chip monolithic integrated circuit. The squelch IC contains the noise amplifier, active noise filter, detector, and the slow squelch circuit.

Noise from the IF/DET is coupled through the fixed squelch adjust control R901 to pin 1 of U901. This signal is applied to the noise amplifier and then to the active filter circuit.

The noise amplifier and active filter provide the gain and selectivity to distinguish between noise and audio. The filter output drives the active detector circuit to provide the squelch switching functions. Thermistor RT601 keeps the input to the active detector constant over wide variations in temperature. The slow squelch circuit provides a 200 millisecond squelch operation to prevent rapid squelch opening and closing in weak signal areas.

The squelch switch output at pin 7 of U901 is connected to the receiver mute control circuit. When the receiver is squelched, the output at pin 7 is near A-. This keeps Q902 turned off, allowing Q903 to conduct. Conduction of Q903 applies a low to pin 7 of AR901, turning the amplifier off and muting the receiver. When the receiver is quieted by an on-frequency signal (unsquelches), the voltage at pin 7 of U901 rises to approximately +10 Volts. This turns on Q902, preventing Q903 from conducting. The resulting high at pin 7 of AR901 turns on the amplifier and audio is heard at the speaker.

With the receiver unsquelched, the output of the squelch switch turns on the RUS switch. The output of the RUS switch is connected to the noise amplifier, providing a hysteresis loop in the squelch circuit. The RUS output increases the gain of the noise amplifier, preventing squelch closing on weak signals.

NOTE

In Channel Guard radios, the squelch circuit will operate only when an on-frequency signal with the correct Channel Guard tone is applied to the receiver.

Squelch Disable

Placing the Squelch switch S702 (located on the Control Panel) in the TEST position applies bias to the base of Q901 on the SAS board. The transistor is operated. Conduction of Q901 operates Q902, grounding the base of Q903 and preventing it from operating. As long as this condition remains, the squelch circuit is disabled. In Channel Guard radios, moving the Squelch switch S702 to the MON position applies ground to the CG DISABLE circuit on the Channel Guard board. This results in removing the low on the RX MUTE lead at J906-5 and the base of Q902, enabling the squelch circuit.

Transmitter Keying and Delay

Pressing the PTT (TRANSMIT) switch on the microphone connects pin 8 of U902 to A-. Capacitor C924 starts to charge. In 20 milliseconds C924 is charged to a voltage high enough to allow the time delay switch in U902 to turn on. This causes the transmitter oscillator control switch in U902 to turn on. +10 Volts is applied via pin 14 of U902 to the transmitter oscillator, keying the transmitter. The voltage at pin 7 of U902 goes low under these conditions, removing the receiver oscillator control voltage.

The 20 millisecond time delay in the transmitter oscillator keying circuit allows the antenna relay to energize before RF is applied to the relay.

Operating the PTT switch turns on the receiver muting and delay circuit in U902, applying A- to pin 6. Q902 is now prevented from operating, muting the receiver. C923 starts to charge from the +10-Volt line. When the PTT switch is released, C923 keeps the A- voltage at pin 6 for approximately 50 milliseconds. This delays the turn-on of the receiver audio at the end of a transmission.

Transmitter Disable

In radios equipped with a Carrier Control Timer, pin 11 of U902 connects to the TX DISABLE lead of the Carrier Control Timer. When the timing cycle on the timer runs out, A- is applied to pin 11, turning off the transmitter oscillator control voltage which turns off the transmitter.

CRYSTAL MODULE (5 PPM Oscillator)

Crystal modules determine the operating frequency of the transmitter and receiver. The plug-in module contains a crystal, a trimmer capacitor and a varicap temperature compensation.

The quartz crystal used in the crystal module exhibits the traditional "S" curve characteristics of output frequency versus operating temperature as shown in Figure 1. In the mid-temperature range (-10°C to +50°C), the raw crystal characteristics are maintained. The compensation voltage which drives the crystal module varicap is approximately constant over this temperature range; consequently, the crystal almost solely determines the temperature characteristics. The crystals whose temperature characteristics lie toward the high limit of +4 parts per million (PPM) are rotated slightly. All others have little to no rotation.

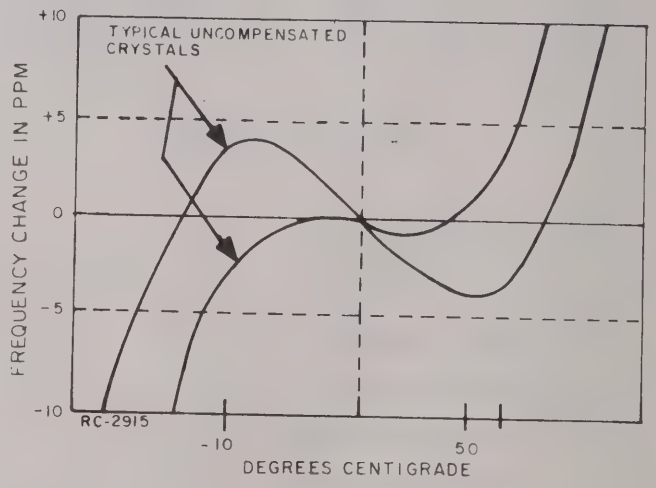


Figure 1 - Crystal Characteristics

The cold end temperature characteristic is "lifted" by a temperature-dependent increasing voltage. The compensator which drives the crystal module varicap produces a voltage which increases linearly from -10°C to -30°C. This voltage decreases the varicap capacity which, in turn, increases the module tuned circuit frequency to compensate for the decreasing frequency characteristics of the crystal.

The hot end crystal temperature characteristic shown in Figure 1 is increasing with temperature. Above 50°C, the hot end crystal characteristic is compensated for by a decreasing voltage from the compensator. This results in added capacity from the varicap, decreasing the module frequency to counteract the increasing frequency response of the crystal.

Compensation voltage from the exciter is applied to pin 4 of the crystal modules to maintain frequency stability within 5 parts-per-million (PPM) over a temperature range of -30°C to +60°C.

SERVICE NOTE

Proper crystal module operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should all of the crystal modules shift off-frequency, check the 10-Volt regulator.

The compensation voltage varies non-linearly with temperature to complement the temperature/frequency characteristics of the crystal. Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules, as measured with a high impedance meter.

TEMPERATURE RANGE	OUTPUT VOLTAGE	
	MINIMUM	MAXIMUM
-30°C	4.9 Volts	6.0 Volts
-10° to +50°C	3.7 Volts	4.3 Volts
75°C	3.3 Volts	3.8 Volts

Trimmer capacitor C3 is used to adjust the radio for the exact operating frequency. Refer to the applicable Alignment Procedure for details.

Operating voltage for the crystal module is supplied from the Tx or Rx OSC control circuit on the SAS board or through the biased PIN diode on the multi-frequency board to pin 1 of the selected crystal module.

Multi-Frequency Kit (5 PPM Oscillators)

The Multi-Frequency Kit is provided in radios with more than one operating frequency. It contains the necessary circuitry to provide three additional transmit and three additional receive frequencies to the standard radio. The multi-frequency board utilizes crystal modules to determine the exact operating frequencies.

The transmit and receive oscillator circuits are identical, each using a single transistor in conjunction with the selected crystal module to comprise the oscillator circuit. Crystal modules are selected for operation by the frequency select lead from the control panel. PIN diodes are used to switch the output of the selected crystal module to the base of the appropriate transistor, Q2601 (receive) and Q2602 (transmit).

Since the oscillator circuits are identical, only the F2 circuits are described here. When F2 is selected by S703 at the control panel, A- is applied to the junction of R2603 and R2606 and to the junction of C2608 and R2611. PIN diodes CR2601 and CR2604 are now forward biased, applying the output of the crystal modules (pin 1) to the base of the common oscillator transistors Q2601 and Q2602. The selected crystal modules (Y2601 and Y2604) and transistor circuits comprise two Colpitts oscillators.

The oscillator control voltage, required for transmit oscillator operation, is controlled by the transmit keying and delay circuits on the SAS board. Pressing the PTT switch applies the transmit oscillator control voltage (+10 VDC) to the emitter-base circuit of Q2602, causing it to oscillate at the assigned F2 crystal frequency.

A plug-in coaxial cable (W2602) connects the output of the oscillator to J102 on the exciter board. When the PTT switch is released, the transmit oscillator control voltage is removed from Q2602 and the anode of CR2604. Q2602 stops oscillating, removing the input to the exciter.

When the PTT switch is released, the receive oscillator control voltage from the keying and delay circuit on the SAS board is applied to the emitter-base circuit of Q2601. Since the transmit and receive modules are selected simultaneously, Q2601 now oscillates at the F2 receive crystal frequency and provides an output to J401 on the receive OSC/MULT board through cable W2601.

When a different frequency is selected, A- is removed from the junction of R2603-R2606 and the junction of R2611-C2608. This reverse biases PIN diodes CR2601 and CR2604, removing the crystal module outputs from the base circuits of the oscillators.

Compensator Circuit

The crystal modules on the Multi-Frequency Board are temperature compensated at both ends of the temperature range to provide instant frequency compensation. The temperature compensator is located on the transmitter exciter.

2 PPM UHF Transmit Oscillator Board

In those applications requiring 2 PPM UHF transmitter frequency stability, the 19C327107G1 Oscillator Board is required. This board accomodates one Integrated Circuit Oscillator Module (ICOM). The ICOM is enclosed in a dustproof, RF shielded can with the type (2C-ICOM) printed on top of the can. The 2C-ICOM contains an oscillator and a 2 PPM (±0.0002%) compensator IC.

Access to the oscillator trimmer is accomplished by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOM out of the radio.

The output of the ICOM oscillator is connected through cable W2102 to the XY101 position on the transmitter exciter board.

The 2C-ICOM is temperature compensated at both ends of the temperature range to provide instant frequency compensation.

The cold end compensation circuit does not operate at temperatures above 0°C. When the temperature drops below 0°C, the circuit is activated. As the temperature decreases, the equivalent resistance decreases and the compensation voltage increases.

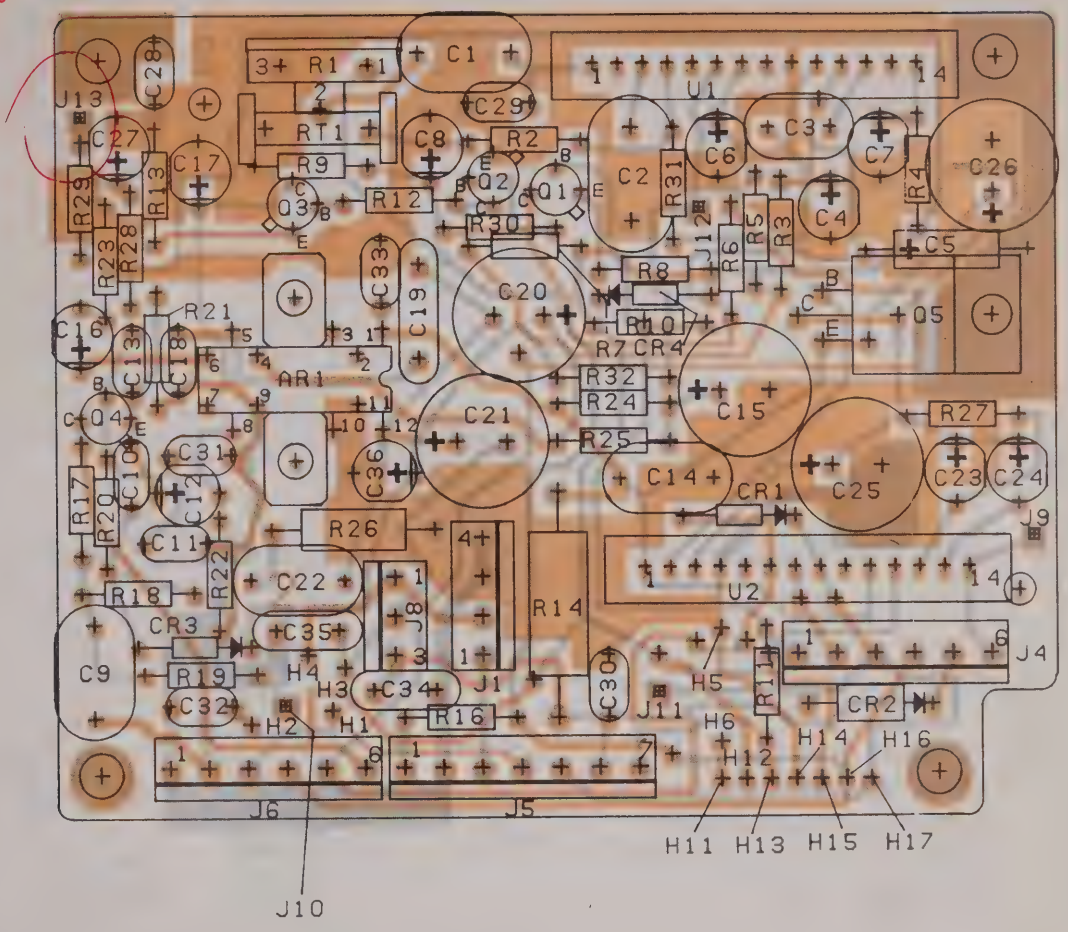
The increase in compensation voltage decreases the capacity of the varactor in the oscillator, increasing the output frequency of the ICOM.

The hot end compensation circuit does not operate at temperatures below +55°C. When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the equivalent resistance decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the ICOM.

SERVICE NOTE

Proper ICOM operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should the ICOM shift off frequency, check the 10-Volt regulator or the output of the ICOM.

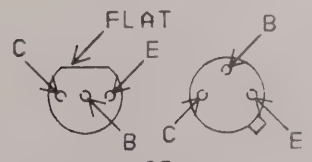
913 MIC BIAS



(19C327101, Rev. 3)
(19B227189, Sh. 2, Rev. 2)
(19B227189, Sh. 3, Rev. 2)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR COMPLETE DESIGNATION PREFIX WITH 900 SERIES.
EXAMPLE: C1-C901 , R1-R901 , ETC.

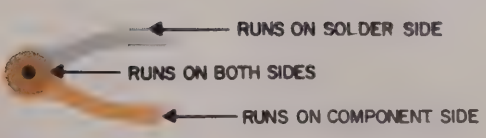
LEAD IDENTIFICATION
FOR Q1-Q4



TOP VIEW

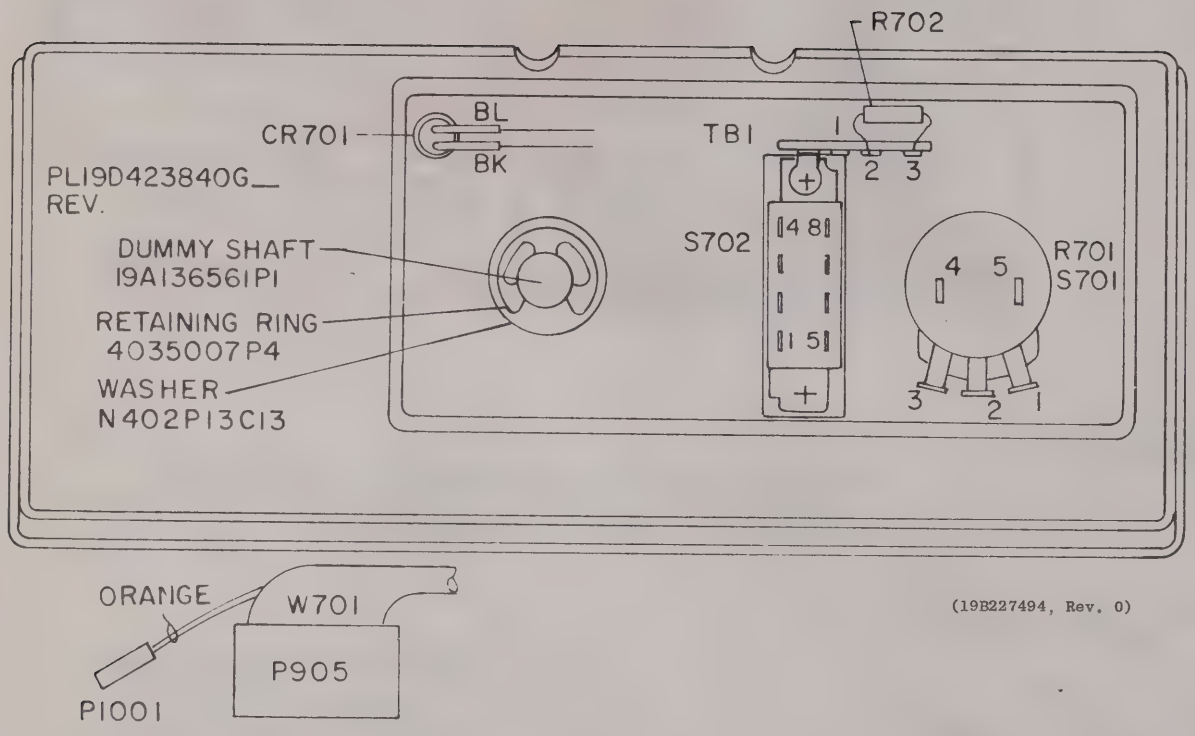
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

REFER TO WIRING DIAGRAM 19D423734 FOR THE FOLLOWING CONNECTIONS	
FROM	TO
H1	H2
H3	H4



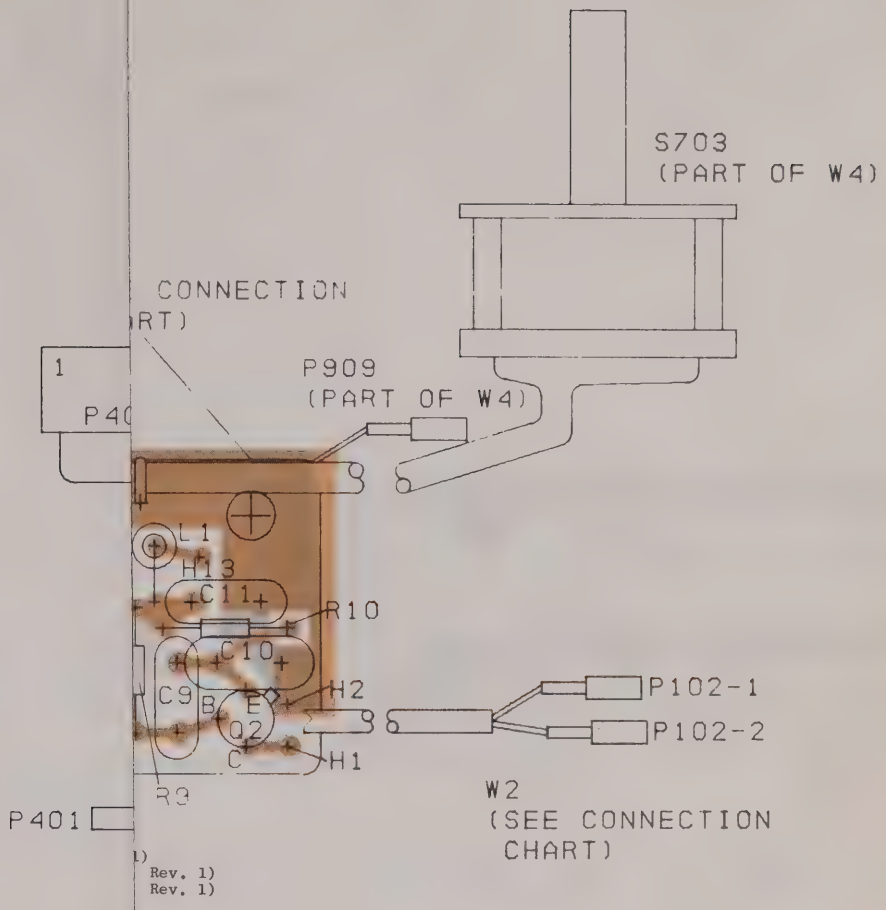
OUTLINE DIAGRAM

SYSTEM-AUDIO-SQUELCH BOARD
19C321920G1



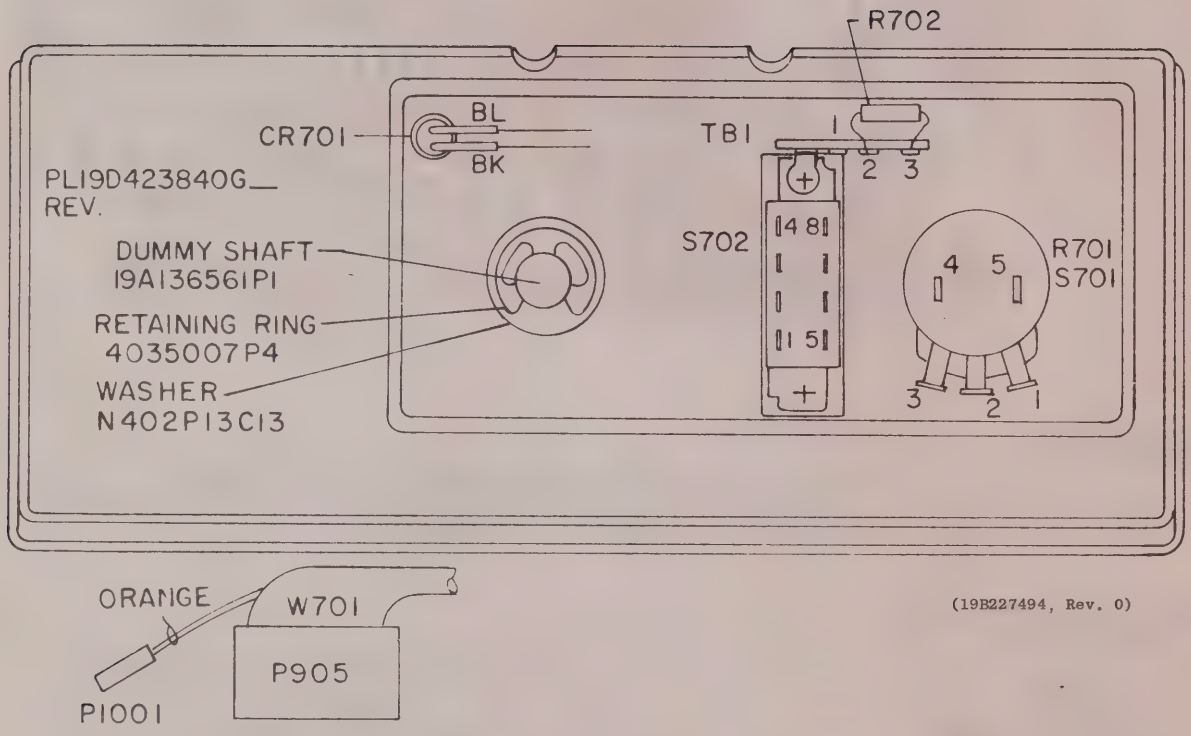
OUTLINE DIAGRAM

CUSTOM MVP CONTROL PANEL
19D423840G1



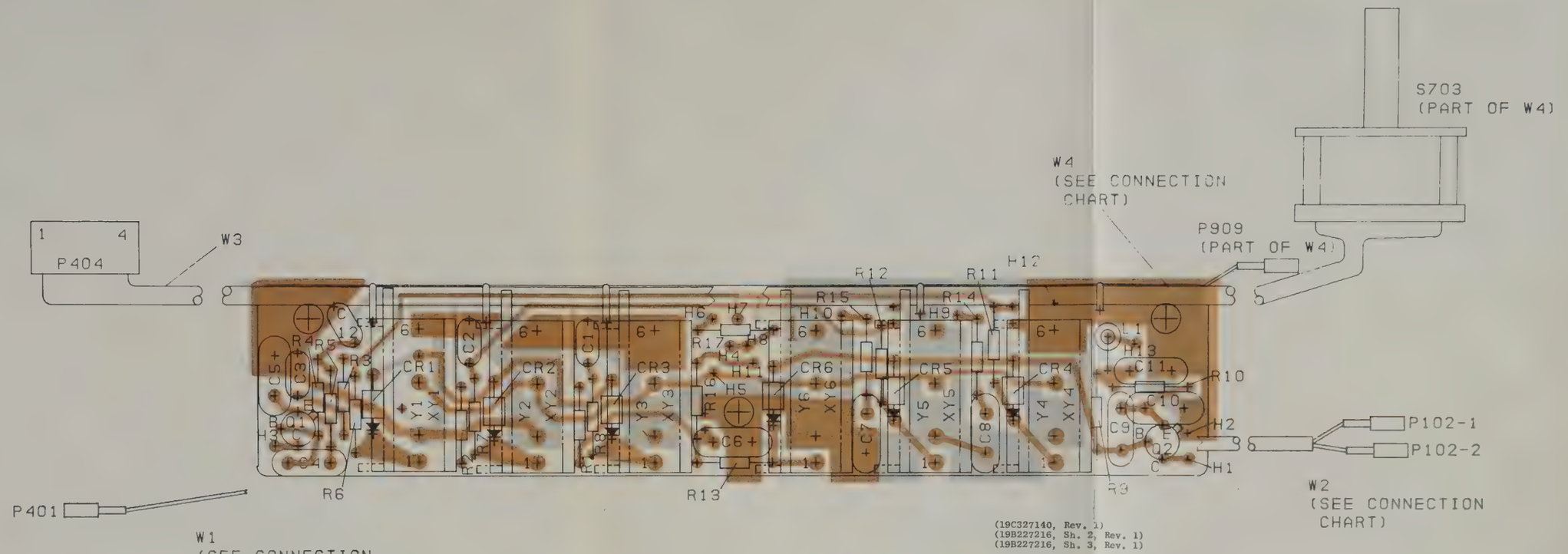
OUTLINE DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2



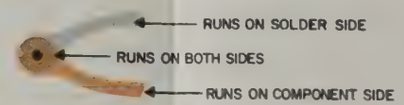
OUTLINE DIAGRAM

CUSTOM MVP CONTROL PANEL
19D423840G1

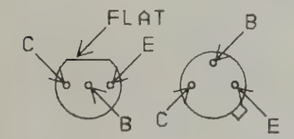


CONNECTION CHART		
WIRE	TO	REMARKS
W1	H3	
W2	H1	CENTER COND
W2	H2	SHIELD
W3-W	H7	
W3-R	H6	
W3-BL	H5	
W3-BR	H4	
W4-BR	H8	
W4-R	H9	
W4-O	H10	
W4-Y	H11	
W4-BK	H12	
W4-G	H13	

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 2600 SERIES
EXAMPLE: C1=C2601, R1=R2601..., ETC.



LEAD IDENTIFICATION
FOR Q1 AND Q2



OR

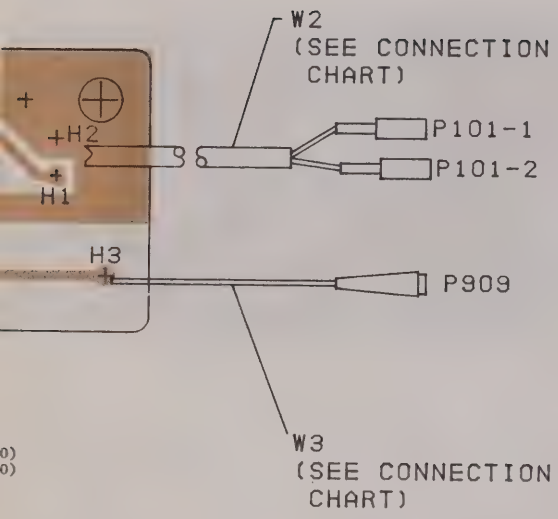
IN-LINE TRIANGULAR

TOP VIEW

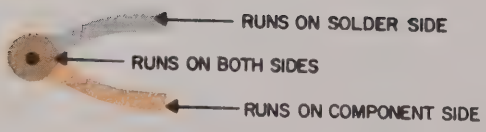
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

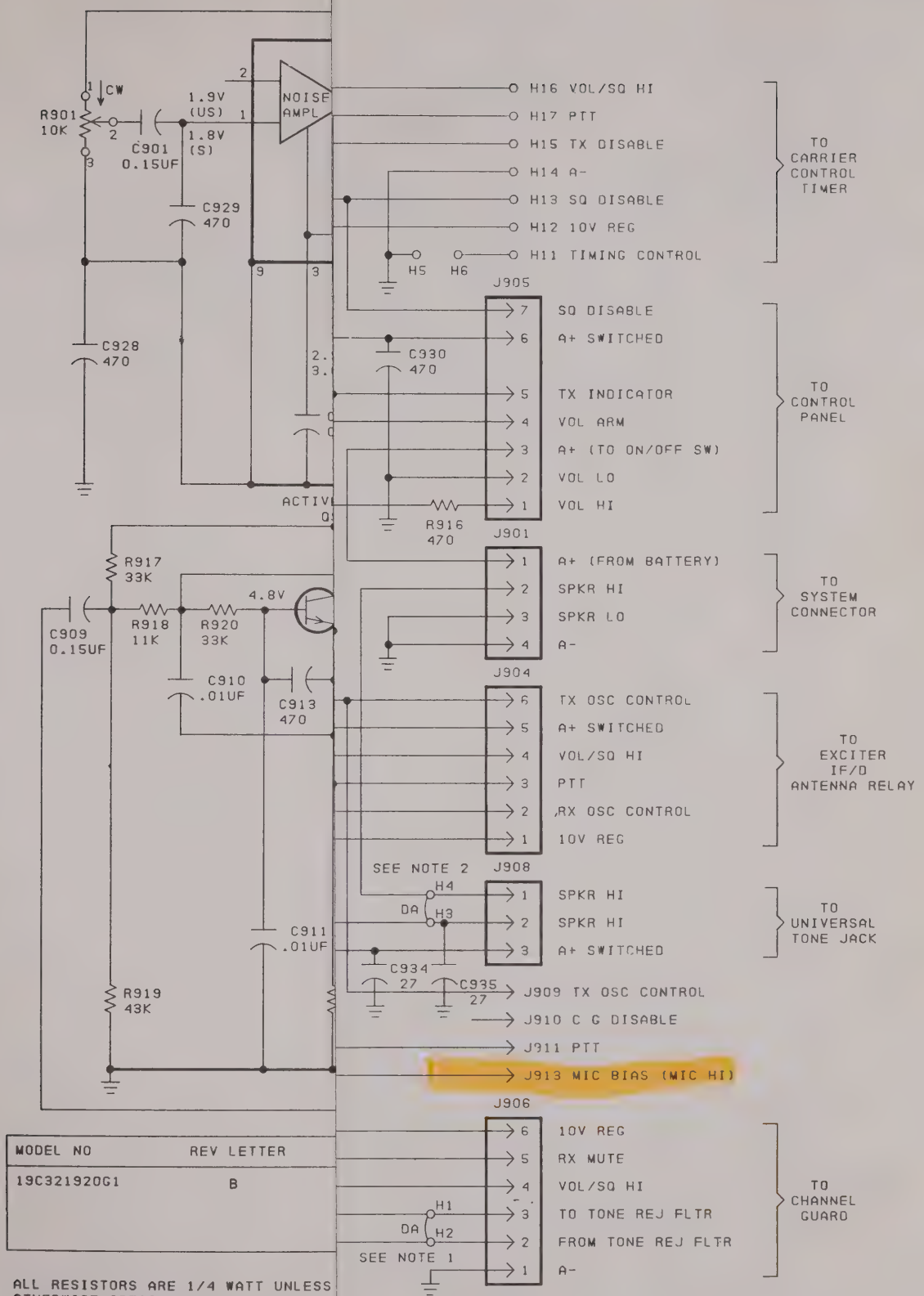
OUTLINE DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 2100 SERIES
EXAMPLE: C1-C2101, R1-R2101...ETC.



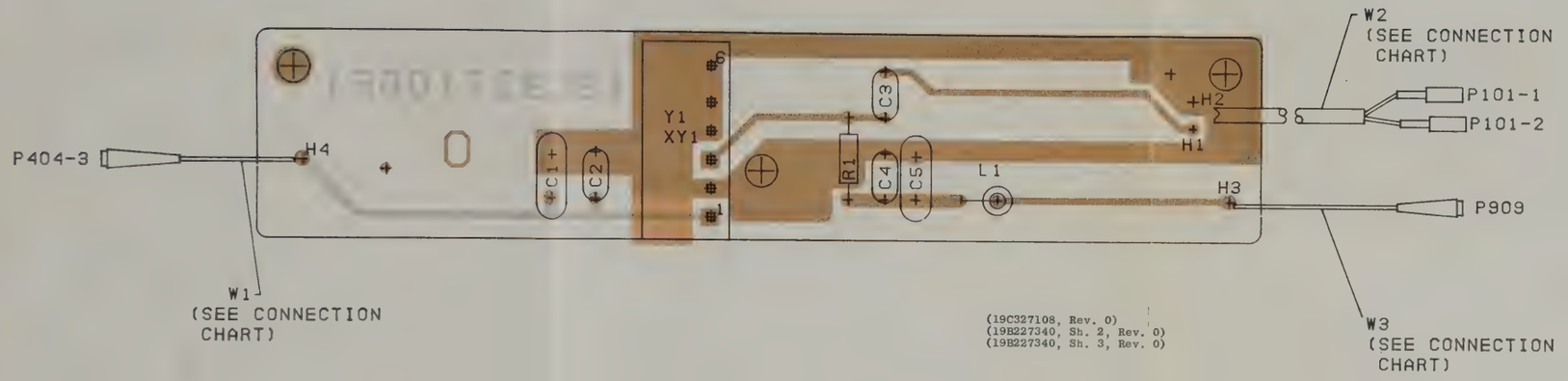


MODEL NO	REV LETTER
19C321920G1	B

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (E TO MICROMICROFARADS) UNLESS FOLLOW BY UF-MICROFARADS.

SCHEMATIC DIAGRAM

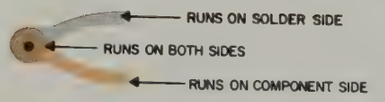
SYSTEM-AUDIO-SQUELCH BOARD 19C321920G1



(19C327108, Rev. 0)
(19B227340, Sh. 2, Rev. 0)
(19B227340, Sh. 3, Rev. 0)

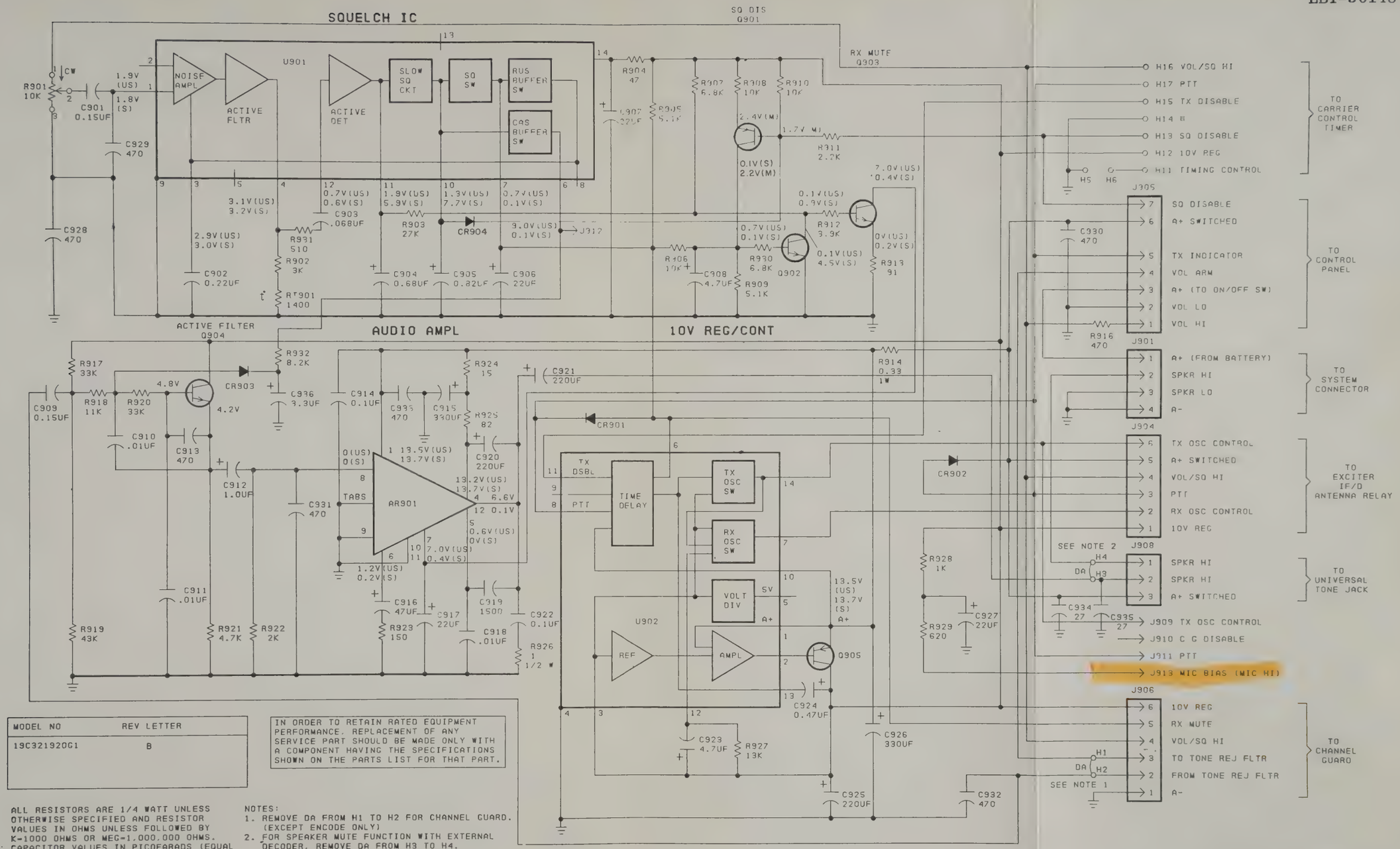
PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 2100 SERIES
EXAMPLE: C1-C2101, R1-R2101...ETC.

CONNECTION CHART		
WIRE	TO	REMARKS
W1	H4	
W2	H1	CENTER COND
W2	H2	SHIELD
W3	H3	



OUTLINE DIAGRAM

2 PPM OSCILLATOR BOARD
19C327107G1



MODEL NO	REV LETTER
19C321920G1	B

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS.

NOTES:
1. REMOVE DA FROM H1 TO H2 FOR CHANNEL GUARD. (EXCEPT ENCODE ONLY)
2. FOR SPEAKER MUTE FUNCTION WITH EXTERNAL DECODER, REMOVE DA FROM H3 TO H4.

(19D423734, Rev. 3)

SCHEMATIC DIAGRAM

SYSTEM-AUDIO-SQUELCH BOARD
19C321920G1

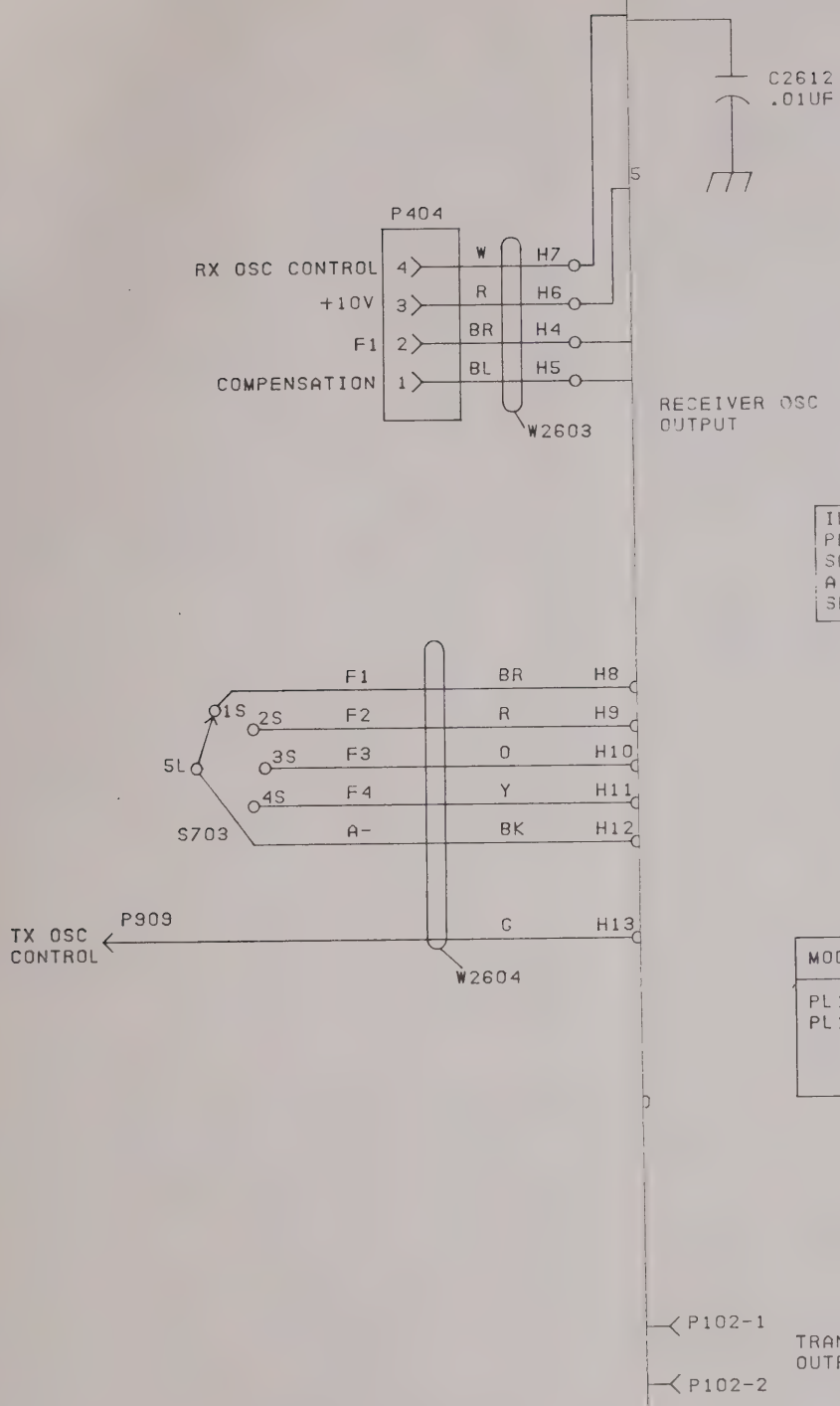
Issue 2

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for description of parts affected by these revisions.

Rev. A - To improve performance. Added C936, CR903, R932. Changed C917, R931, V901.

Rev. B. - To allow proper squelch monitor function. Added CR904.



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

MODEL NO	REV LETTER
PL19C321954G1 PL19C321954G2	

SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2

PARTS LIST

LBI-30136A

MASTR CUSTOM MVP
SYSTEM - AUDIO - SQUELCH BOARD
19C321920G1

SYMBOL	GE PART NO.	DESCRIPTION
AR901	19A134339P1	Integrated circuit, linear: sim to SGS-ATES TBA810AS.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C901	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C902	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C903	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C904	19A134202P13	Tantalum: 0.68 µf ±20%, 35 VDCW.
C905	5496267P230	Tantalum: 0.82 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C906 and C907	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C908	19A134202P3	Tantalum: 4.7 µf ±20%, 10 VDCW.
C909	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C910 and C911	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C912	19A134202P14	Tantalum: 1 µf ±20%, 35 VDCW.
C913	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C914	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C915	19A134319P2	Electrolytic: 330 µf +75% -10%, 25 VDCW; sim to Sprague 502D189.
C916	19A134202P2	Tantalum: 47 µf ±20%, 6 VDCW.
C917*	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
		Earlier than REV A:
	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C918	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C919	5494481P124	Ceramic disc: 1500 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C920 and C921	19A134319P1	Electrolytic: 220 µf +75% -10%, 25 VDCW; sim to Sprague 502D182.
C922	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C923	19A134202P3	Tantalum: 4.7 µf ±20%, 10 VDCW.
C924	19A134202P12	Tantalum: 0.47 µf ±20%, 35 VDCW.
C925	19A134319P1	Electrolytic: 220 µf +75% -10%, 25 VDCW; sim to Sprague 502D182.
C926	19A134319P2	Electrolytic: 330 µf +75% -10%, 25 VDCW; sim to Sprague 502D189.
C927	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C928 thru C933	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C934 and C935	19A116656P27J0	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef 0 PPM.
C936*	19A134202P5	Tantalum: 3.3 µf ±20%, 15 VDCW. Added by REV A.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR901	19A115250P1	Silicon.
CR902	4037822P1	Silicon.
CR903*	19A115250P1	Silicon. Added by REV A.
CR904*	19A115250P1	Silicon. Added by REV B.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J901	19A116659P103	Connector, printed wiring: 4 contacts; sim to Molex 09-60-1041.
J904	19A116659P105	Connector, printed wiring: 6 contacts; sim to Molex 09-60-1061.
J905	19A116659P106	Connector, printed wiring: 7 contacts; sim to Molex 09-60-1071.
J906	19A116659P105	Connector, printed wiring: 6 contacts; sim to Molex 09-60-1061.
J908	19A116659P101	Connector, printed wiring: 3 contacts; sim to Molex 09-60-1031.
J909 thru J913	19A116779P5	Contact, electrical: sim to Molex 08-50-0414.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q901	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q902 thru Q904	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q905	19A116375P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R901	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R902	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R903	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R904	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R905	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R906	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R907	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R908	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R909	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R910	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R911	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R912	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R913	3R152P910J	Composition: 91 ohms ±5%, 1/4 w.
R914	19B209022P103	Wirewound: .33 ohms ±10%, 2 w; sim to IRC Type BWH.
R916	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R917	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R918	3R152P113J	Composition: 11,000 ohms ±5%, 1/4 w.
R919	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R920	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R921	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R922	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R923	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R924	3R152P150K	Composition: 15 ohms ±10%, 1/4 w.
R925	3R152P820K	Composition: 82 ohms ±10%, 1/4 w.
R926	7147161P19	Composition: 1.0 ohms ±5%, 1/2 w.
R927	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R928	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R929	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R930	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R931*	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
		Earlier than REV A:
	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
R932*	3R152P822J	Composition: 8200 ohms ±5%, 1/4 w. Added by REV A.
		- - - - - - - - - THERMISTORS - - - - - - - -
RT901	5490828P38	Thermistor: 1400 ohms ±5%, color code green and white; sim to Carborundum Type 723H-2.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U901*	19D416560G2	Hybrid Squelch.
		Earlier than REV A:
	19D416560G1	Hybrid Squelch.
U902	19D416564G3	Regulator, 10 volt.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PRODUCTION CHANGES

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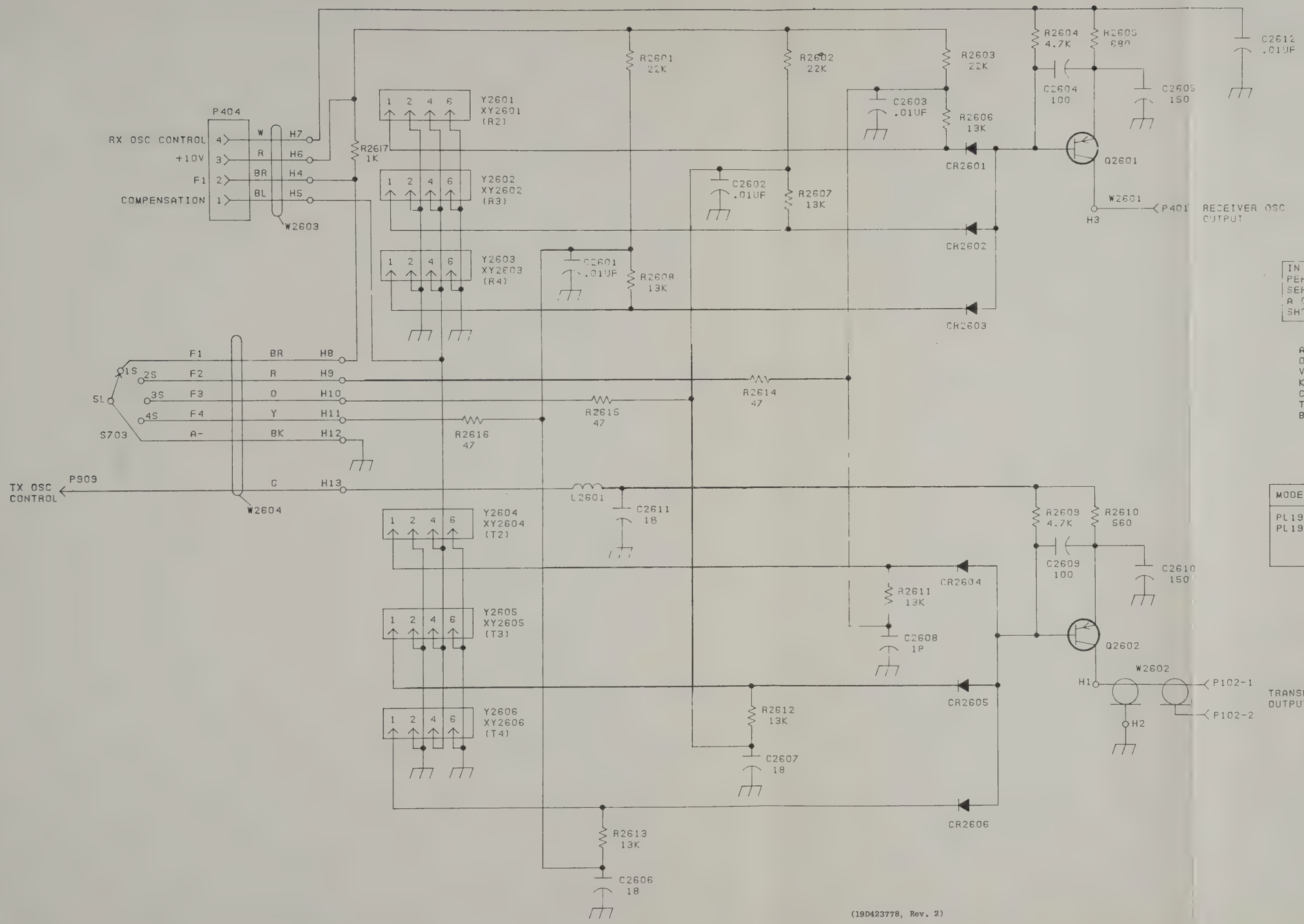
Rev. A - To improve performance. Added C936, CR903, R932. Changed C917, R931, V901.

Rev. B. - To allow proper squelch monitor function. Added CR904.



(19D423778, Rev. 2)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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MODEL NO	REV LETTER
PL19C321954G1 PL19C321954G2	

SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2

MODEL NO	REV LETTER
PL19C327107G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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(19C327147, Rev. 1)

SCHEMATIC DIAGRAM

2 PPM OSCILLATOR BOARD 19C327107G1

PARTS LIST

LBI-30180A

MULTI-FREQUENCY BOARD
19C321954G1 HIGH BAND/LOW BAND
19C321954G2 UHF BAND

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2601 thru C2603	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C2604	5496218P763	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2605	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2606 thru C2608	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2609	5496218P763	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2610	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2611	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2612	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2601 thru CR2606	19A116925P4	Silicon.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2601	19A129773G3	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P102	19A127042P2	Terminal, solderless: sim to Malco 12093-10. (Part of W2603A, W2602B).
P401	19A127042P2	Terminal, solderless: sim to Malco 12093-10. (Part of W2601).
P404	19A116659P84	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3103. (Part of W2603).
P909		(Part of W2604).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2601 and Q2602	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2601 thru R2603	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2604	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R2605	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R2606 thru R2608	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R2609	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R2610	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R2611 thru R2613	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R2614 thru R2616	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R2617	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S703		(Part of W2604).

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W2601	19A129947G2	Single conductor: approx 3 inches long. (Includes P401).
W2602A	19A130744G5	Two conductor: approx 7 inches long. (Includes P102).
W2602B	19A130744G6	2 conductor: approx 2.5 inches long. (Includes P102).
W2603	19B226965G3	2 conductor: approx 5.5 inches long. (Includes P404).
W2604		CABLE ASSEMBLY 19B227315G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S703	5495454P45	Rotary: 1 section, 1 pole, 2 to 4 positions (with adj. stop), non-shorting contacts, 2 amps at 25 VDC or 1 amp at 110 VAC; sim to Oak Type "A".
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2601 thru XY2606	19A130958G1	Connector, printed wiring: 6 contacts; sim to Molex 09-65-1061.
		- - - - - - - - - CRYSTAL MODULES - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact transmitter or receiver frequency needed.
Y2601 thru Y2606	19B226962G1	Tx. 5 PPM (30-36 MHz).
	19B226962G2	Tx. 5 PPM (36-42 MHz).
	19B226962G3	Tx. 5 PPM (42-50 MHz).
	19B226962G4	Tx. 5 PPM (138-155 MHz).
	19B226962G5	Tx. 5 PPM (150.8-174 MHz).
	19B226962G6	Tx. 5 PPM (406-420 MHz).
	19B226962G7	Tx. 5 PPM (450-470 MHz).
	19B226962G8	Tx. 5 PPM (470-494 MHz).
	19B226962G9	Tx. 5 PPM (494-512 MHz).
	19B226962G10	Rx. 5 PPM (30-36 MHz).
	19B226962G11	Rx. 5 PPM (36-42 MHz).
	19B226962G12	Rx. 5 PPM (42-50 MHz).
	19B226962G13	Rx. 5 PPM (138-155 MHz).
	19B226962G14	Rx. 5 PPM (150.8-174 MHz).
	19B226962G15	Rx. 5 PPM (406-420 MHz).
	19B226962G16	Rx. 5 PPM (450-470 MHz).
	19B226962G17	Rx. 5 PPM (470-494 MHz).
	19B226962G18	Rx. 5 PPM (494-512 MHz).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	N80P13016C6	Screw, panhead: No. 6-32 x 1.
	7165075P4	Hex nut, brass: thd. size No. 3/8-32.
	N404P13C6	Lockwasher, internal tooth: No. 6.
	19B227473G1	Support.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

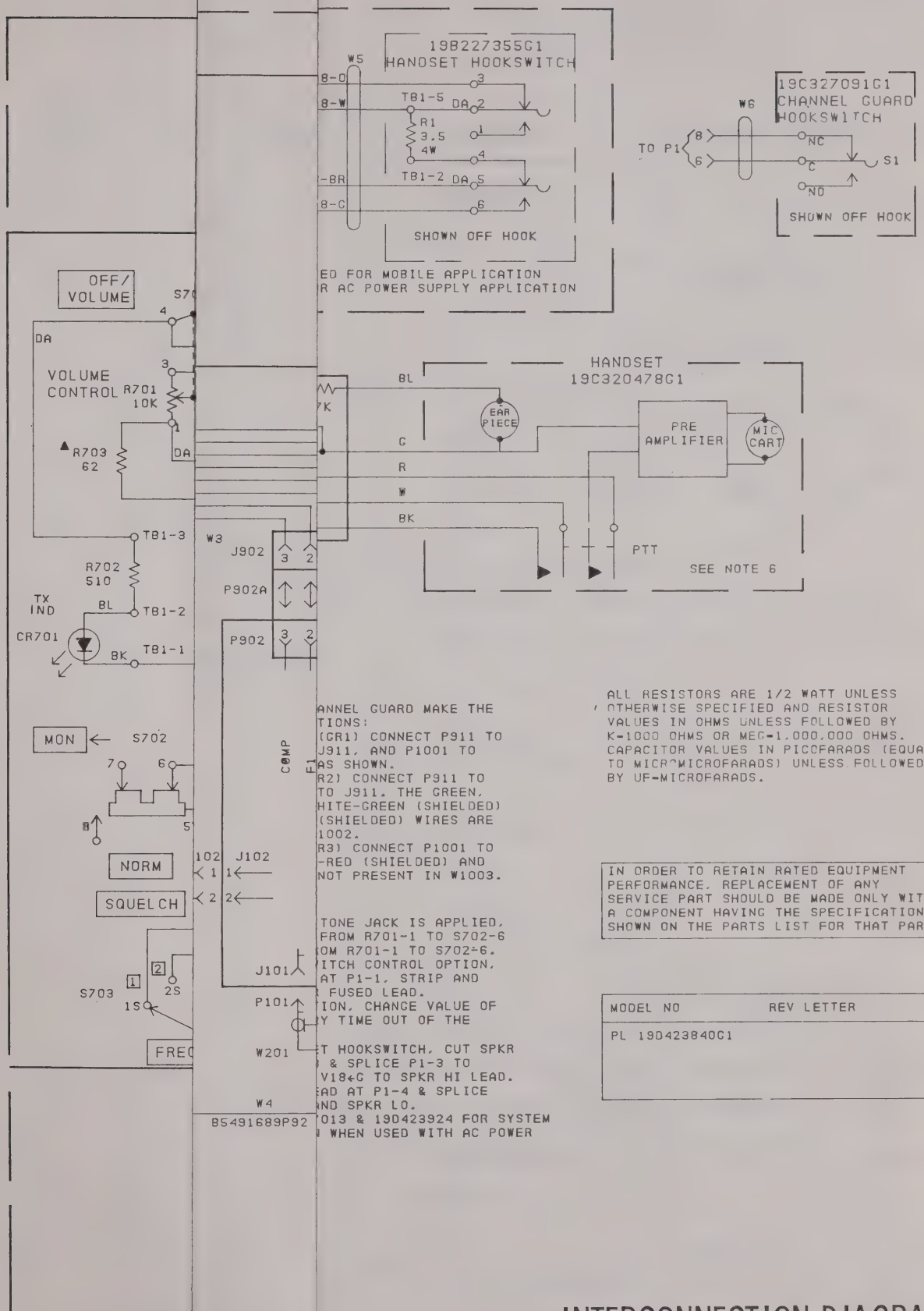
PARTS LIST

LBI-30179

2 PPM OSCILLATOR BOARD
19C327107G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2101	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2102 thru C2104	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C205	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2101	19A129773G3	Coil.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4036634P1	Contact, electrical; sim to AMP 42428-2.
P404-3	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2101	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W2101	19A129947G2	Single conductor: approx 3 inches long.
W2102	19A130744G4	2 conductor: approx 4 inches long.
W2103	19A129947G5	Single conductor.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2101	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 6).
		- - - - - - - - - - - Tx ICOMS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency For STANDARD LOW SIDE INJECTION FREQUENCY.
		ICOM FREQ. = $\frac{\text{Operating Freq.}}{36}$
Y2101	19A129393G15	Externally compensated: ±2 PPM, 406-512 MHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



INTERCONNECTION DIAGRAM

MASTR CUSTOM MVP

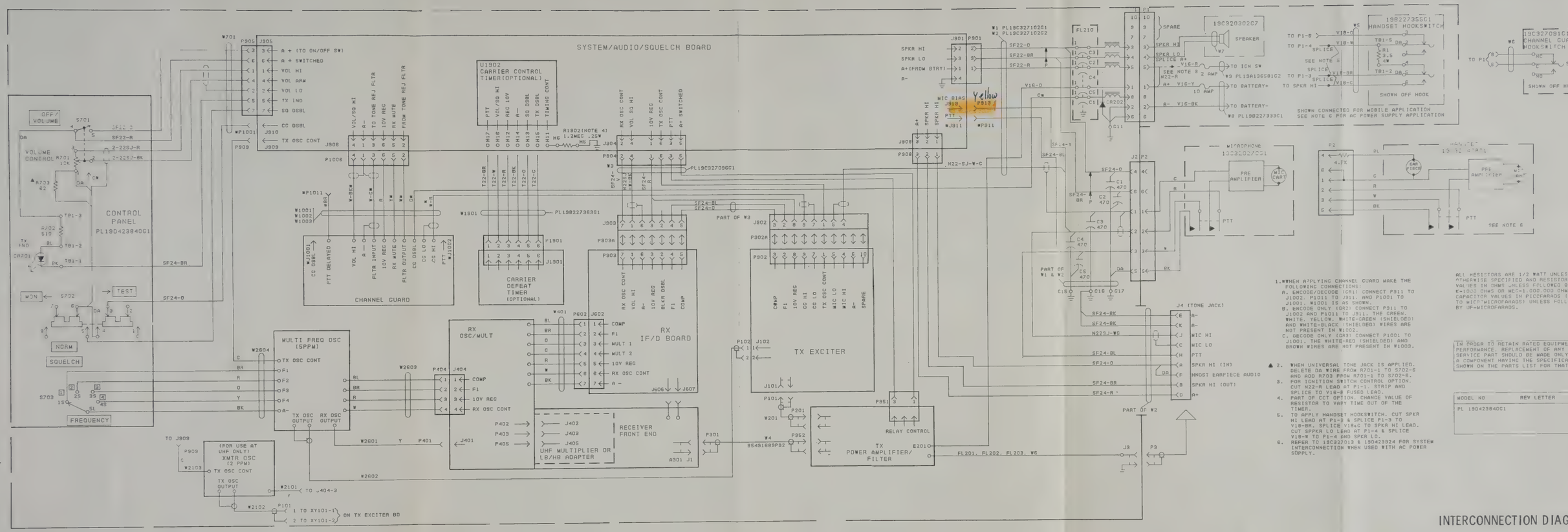
PARTS LIST

LBI-30179

2 PPM OSCILLATOR BOARD
19C327107G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2101	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2102 thru C2104	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C205	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2101	19A129773G3	Coil.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4036634P1	Contact, electrical; sim to AMP 42428-2.
P404-3	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2101	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2101	19A129947G2	Single conductor: approx 3 inches long.
W2102	19A130744G4	2 conductor: approx 4 inches long.
W2103	19A129947G5	Single conductor.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2101	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 6).
		- - - - - - - - - - Tx ICOMS - - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency For STANDARD LOW SIDE INJECTION FREQUENCY.
		ICOM FREQ. = $\frac{\text{Operating Freq.}}{36}$
Y2101	19A129393G15	Externally compensated: ±2 PPM, 406-512 MHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



1. ▲WHEN APPLYING CHANNEL GUARD MAKE THE FOLLOWING CONNECTIONS:
   A. ENCODE/DECODE (CR1) CONNECT P311 TO J1002. P1011 TO J311, AND P1001 TO J1001. W1001 IS AS SHOWN.
   B. ENCODE ONLY (CR2) CONNECT P311 TO J1002 AND P1011 TO J311. THE GREEN, WHITE, YELLOW, ▲WHITE-GREEN (SHIELDED) AND WHITE-BLACK (SHIELDED) WIRES ARE NOT PRESENT IN W1002.
   C. DECODE ONLY (CR3) CONNECT P1001 TO J1001. THE WHITE-RED (SHIELDED) AND BROWN WIRES ARE NOT PRESENT IN W1003.
2. ▲ WHEN UNIVERSAL TONE JACK IS APPLIED, DELETE DA WIRE FROM R701-1 TO S702-6 AND ADD R703 FROM R701-1 TO S702-6.
3. FOR IGNITION SWITCH CONTROL OPTION, CUT N22-R LEAD AT P1-1. STRIP AND SPLICE TO V18-B FUSED LEAD.
4. PART OF CCT OPTION. CHANGE VALUE OF RESISTOR TO VARY TIME OUT OF THE TIMER.
5. TO APPLY HANDSET HOOKSWITCH, CUT SPKR HI LEAD AT P1-3 & SPLICE P1-3 TO V18-BR. SPLICE V18-C TO SPKR HI LEAD. CUT SPPKR LO LEAD AT P1-4 & SPLICE V18-W TO P1-4 AND SPKR LO.
6. REFER TO 19C327013 & 190423924 FOR SYSTEM INTERCONNECTION WHEN USED WITH AC POWER SOPPLY.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

MODEL NO	REV LETTER
PL 190423840C1	

INTERCONNECTION DIAGRAM

MASTR CUSTOM MVP

PARTS LIST

LBI-30194A

SPEAKER
19C320302G7

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - LOUDSPEAKERS - - - - - - - - -
LS2	19A116910P1	Permanent magnet: 5 inch, 3.2 ohms ±15% imp, 5 w max operating; sim to Pioneer 002009.
		- - - - - - - - - - CABLES - - - - - - - - - -
W5	19A136574G1	Power: 2 conductor. (Includes 2- 19A115884P8 contacts).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B219692G1	Grille.
	19B227593G1	Housing.
	19C320016P1	Mounting bracket. (Located between housing and retaining bracket).
	19A116986P108	Tap screw, with lockwasher: No. 7-19 x 1/2. (Secures speaker to housing).
	19A116986P112	Tap screw, with lockwasher: No. 7-19 x 3/4. (Secures grille to housing).
	19A116985P1	Tap screw, with lockwasher: No. 13-16 x 3/4.
	N130P1610C6	Screw, thread forming: No. 10-16 x 5/8. (Secures mounting bracket to mounting surface).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI-30181A

MASTR CUSTOM MVP
AND
ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		CONTROL PANEL 19D423840G1
		- - - - DIODES AND RECTIFIERS - - - - - - -
CR706	19B219800G4	Diode, light emitting.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P905		Connector. Includes:
	19A116659P82	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG sim to Molex 08-50-0108. (Quantity 7).
P1001	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R501		(Part of S701).
R702	3R77P511J	Composition: 510 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	5496870P35	Variable, carbon film: 10,000 ohms ±20%. sim to Mallory LC(10K) FAC. (Includes R702).
S702	19A136564G1	Switch, slide: 2 poles, 3 positions, spring return: sim to Switchcraft 11D-1154.
		- - - - - - - - TERMINAL BOARD - - - - - - - - -
TB1	7487424P18	Miniature, phen: 3 terminals.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W701		HARNESS ASSEMBLY 19D423810G2 (Includes R701, S701, S702, P905, P1001)
		ASSOCIATED ASSEMBLIES
		POWER CABLE 19B227333G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1		Connector. Includes:
	19A115884P11	Shell.
	19A136581G1	Fused lead.
	19A136580G1	Lead.
	19A115884P8	Contact, female: wire range No. 14-20 AWG; sim to AMP 60527-4.
	19A115884P10	Contact, female: wire range No. 22-30 AWG; sim to AMP 60909-4.
	7484390P1	Fuse, quick blowing: 10 amp at 250 v; sim to Littelfuse 314010 or Bussmann ABC-10.
		TRANSMIT/RECEIVE HARNESS 19C327098G1
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J902		Connector. Includes:
	19A116659P81	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
J903	19A136600G1	Connector, printed wiring: 8 contacts; sim to Molex 09-52-3082.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P904		Connector. Includes:
	19A116659P80	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
P931		Connector. Includes:
	19A116659P14	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
		SYSTEM HARNESS 19C329103G1 STANDARD 19C327102G2 WITH TONE
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C5	5494481P7	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Disc.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		(Part of Transmitter PA assembly).
J2	19B219627G1	Connector: 6 contacts.
J4	7489183P7	Receptacle: 9 contacts rated at 7.5 amps max; sim to Winchester W9S-LR-H1SC.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P901		Connector. Includes:
	19A116659P84	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
	19A116781P5	Contact, electrical: wire range No. 16-2. AWG; sim to Molex 08-50-0106.
P908		Connector. Includes:
	19A116659P16	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
P911	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P913	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R703	3R77P620J	Composition: 62 ohms ±5%, 1/2 w.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	403683SP6	Terminal, solder: sim to Shakeproof 2102-06-00.
	19B227467G1	Housing.
	NP280149	Faceplate.
	19A136561P1	Dummy support.
	19B209591P1	Knob. (Used with S701 and dummy support).
	N402P13C13	Plain washer. (Used with dummy support).
	4035007P4	Retainer ring. (Used with dummy support).
	7165075P4	Hex nut, brass: thd. size No. 3/8-32. (Secures S701).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures S702).
	19A134330P1	Knob, push-on. (Used with S702).
	19A116677P2	Bushing: sim to Opcon, Inc. OC-1. (Used with CR701).

PARTS LIST

LBI-30175

CHANNEL GUARD HOOKSWITCH
19C327091G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B209099P1	Sensitive: 10.1 amps at 125 VAC, or .5 amp at 12 VDC; sim to Cherry Electrical Products ES2-10A, SPDT.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B204721P1	Actuator spring.
	4033802P1	Power cable. 2 conductor, approx 4 feet long.
	19A115884P8	Connector, plug: sim to AMP 60527-1. (Located on cable end).
	N193P1408C13	Tap screw: No. 8-18 x 1/2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI-30174A

HANDSET HOOKSWITCH
19D227335G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A136584G1	Handset, holder: 1 amp at 125 v; sim to Telephone Components Inc, Brook-Tel No. 10108.
		- - - - - - - - TERMINAL BOARD - - - - - - - -
TB1	7775500P55	Phen: 2 insulated, 1 grounded terminal.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19B227334G1	4 conductor, approx 30 inches long.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	402P851P8	Clip loop. (Used with W1).
	19B219852P1	Mounting plate.
	19A129586G1	Bumper.
	19A116773P106	Tap screw, Phillips POZIDRIV®: No. 7-19 x 3/8. (Secures clip loop).
	N193P1410P2	Tap screw: No. 8-18 x 5/8. (Secures hookswitch).
	N190P1312C6	Cut screw: No. 6. (Secures bottom of housing to back plate).
	N84P13012C6	Machine screw, flat head: No. 6-32 x 3/4. (Secures upper lhousing to back plate.
	N40P15016C6	Machine screw: No. 8-32 x 1. (Secures rubber bumpers to housing).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

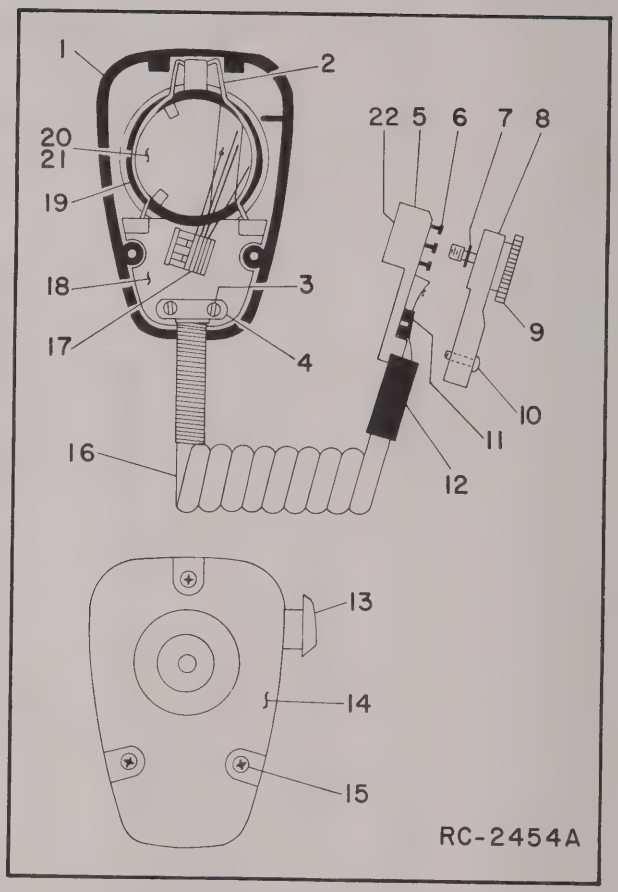
PARTS LIST

LBI-4481A

TRANSISTORIZED DYNAMIC MICROPHONE
19C320270G1
(SEE RC-2454)

SYMBOL	GE PART NO.	DESCRIPTION
1		Front Case Assembly. RP127. (includes items 14, 15).
2		Retaining spring. (Part of item 18).
3		Tap screw, phillips. (Part of item 16).
4		Retaining bar. (Part of item 16).
5	19D416766P1	Connector base.
6	19A129435P1	Contact.
7	7109043P1	Retaining ring.
8	19D416767P1	Connector cover.
9	19B219723G1	Screw.
10	N136AP905C	Tap screw, phillips: No. 4 x 5/16.
11	19A116937P1	Cable clip.
12	19B219749P1	Strain relief.
13		Switch button kit. RP126.
14		Rear Case Assembly. (Part of item 1).
15		Tap screw, phillips. (Part of item 1).
16	19C321016G1	Cable assembly: Includes items 3-12 and cable RP129.
17		Switch Assembly. RP128.
18		Grille Assembly. RP130. (includes items 2, 19, 21).
19		"O" Ring. (Part of item 18).
20		Transistorized Cartridge. RP117.
21		Washer. (Located under cartridge- part of item 18).
22	19C321016G3	Connector assembly: Includes items 5-12.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SERVICE SHEET

DYNAMIC MICROPHONE
19C320270G1

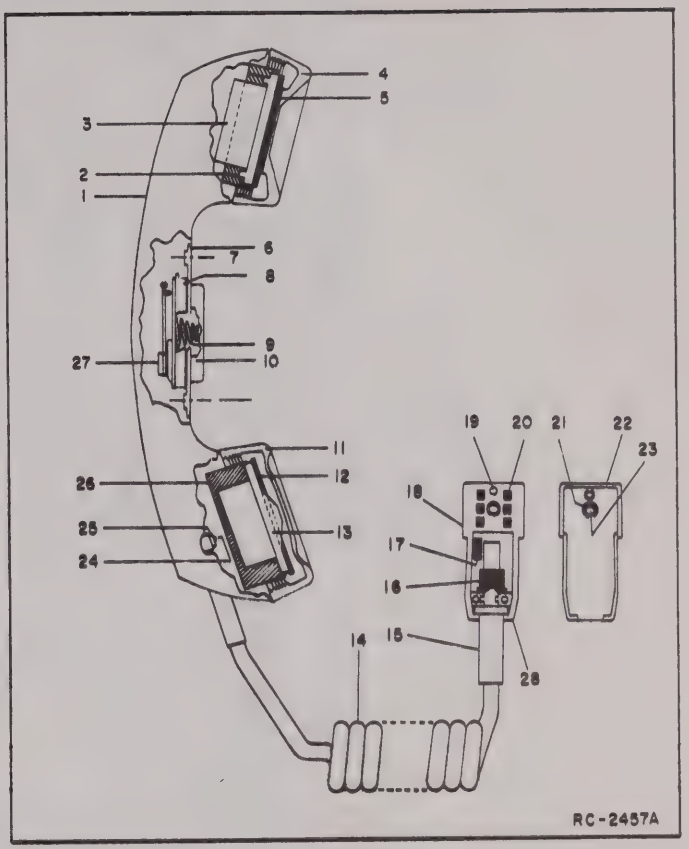
PARTS LIST

LBI-4482A

TRANSISTORIZED DYNAMIC HANDSET
19C320478G1

SYMBOL	GE PART NO.	DESCRIPTION
1		Case Assembly. Includes items 1, 2, 4, 5, 11, 12, 26. Shure Brothers RP142.
2		Adapter. Part of item 1.
3		Receiver Cartridge. Shure Brothers RP140.
4		Receiver Cap. Part of item 1.
5		Washer. Part of item 1.
6		Escutcheon. Part of item 27.
7		Flat head screw, socket cap: No. 4-40 x 1/4. Part of item 27.
8		Actuator. Part of item 27.
9		Spring. Part of item 27.
10		Plunger bar. Part of item 27.
11		Transmitter cap. Part of item 1.
12		Washer. Part of item 1.
13		Transmitter cartridge. Shure Brothers RP130.
14	19C321016G2	Cable assembly: Includes items 14-28 and cable RP141.
15	19B210749P1	Flex relief.
16	19A116087P1	Cable clamp: sim to Uniex S1018-8.
17	8R77R47K	Resistor, (21) Composition, 4700 ohms ±10%, 1/2 w.
18	19D416786P1	Connector case.
19	N136AP808C	Screw.
20	19A129435P1	Pin contact.
21	7109043P1	Retaining ring. 3/16 inch, sim to National Lockwasher WA 510.
22	19D416787P1	Connector Cover.
23	19B219728G1	Screw. (Secures cover, item 22 to case, item 18).
24		Screw. Part of item 14.
25		Cable clamp. Part of item 14.
26		Shield. Part of item 1.
27		Switch Assembly. Includes items 6-10. Shure Brothers RP148.
28	19C321016G3	Connector assembly: Includes items 15, 16, 18-23. Does not include resistor, item 17.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Incorporated into initial shipment.

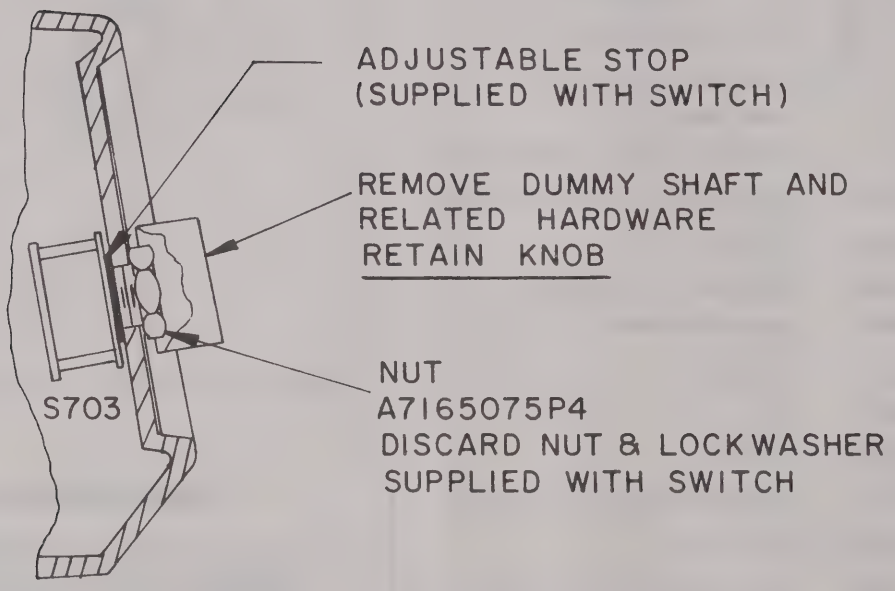
MULTI-FREQUENCY INSTALLATION

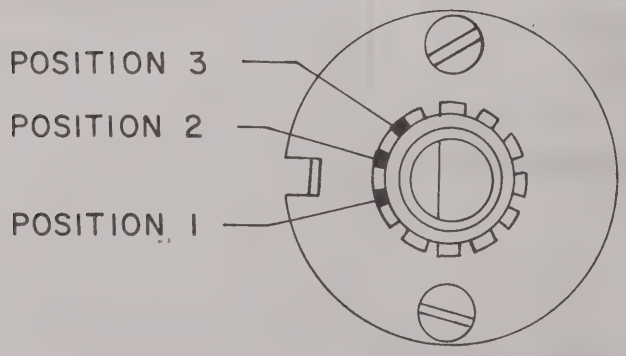
1. WHEN INSTALLING MULTI-FREQ., THE FOLLOWING MODIFICATIONS MUST BE PERFORMED:

   CUT THE BLUE WIRE OUT OF HARNESS (W401) FROM OSC/MULT TO I.F. DETECTOR BD.

   CUT THE ORANGE WIRE OUT OF HARNESS (W3) FROM J902-3 TO J903-5.

2. THE FREQUENCY SELECT SWITCH (S703) STOP IS TO BE SET TO CONFORM WITH THE DESIRED NUMBER OF FREQ.
   ROTATE SWITCH FULLY COUNTERCLOCKWISE.
   FOR 2 FREQ. SET STOP IN POSITION 1.
   FOR 3 FREQ. SET STOP IN POSITION 2.
   FOR 4 FREQ. SET STOP IN POSITION 3.





SWITCH (S703) VIEWED FROM SHAFT END (ENLARGED)

RC-2964

INSTALLATION INSTRUCTION

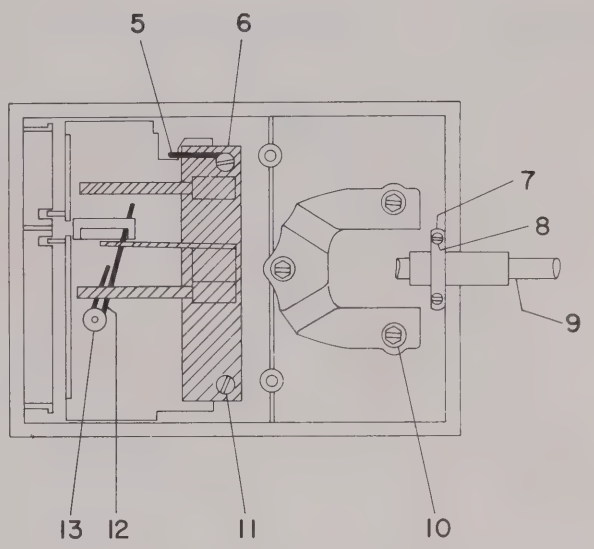
MULTI-FREQUENCY KIT 19C321954

PARTS LIST

LBI-4473

DESK MICROPHONES
19B209458P1 (STANDARD)
19B209459P1 (CHANNEL GUARD
(SEE RC-2459)

SYMBOL	GE PART NO.	DESC
		STANDARD D 19B2
1		Locking plate. (Part
2		Gasket. (Part of item
3		"O" Ring. (Part of it
4		Head Assembly. RP122. 24-26).
5		(Not Used).
6		Switch Kit. RP124.
7		Retaining Bar. (Part
8		Screw, thread forming, (Part of item 9).
9		Cable Kit. RP123. (I
10		Screw, thread forming, (Part of item 20).
11		Screw, thread forming, (Part of item 6).
12		(Not Used).
13		(Not Used).
14		Base plate. (Part of
15		Screw, thread forming, (Secures Base Plate- P
16		Base Assembly. RP125. 19).
17		Pushbutton, Transmit.
18		(Not Used).
19		Nameplate. (Part of i
20		Stem Assembly. RP121.
21		Screw, thread forming, (Part of item 20).
22		Clamp. (Secures Head Part of item 20).
23		Transistorized Cartrid
24		Screw, thread forming, (Part of item 4).
25		Grille. (Part of item
26		Dust cloth. (Part of
		CHANNEL GUARI 19B
1		Locking plate. (Part
2		Gasket. (Part of item
3		"O" Ring. (Part of it
4		Head Assembly. RP122. 24-26).
5		Lock spring. (Part of
6		Switch Kit. RP119. 13, 17, 18).
7		Retaining Bar. (Part
8		Screw, thread forming, (Part of item 9).
9		Cable Kit. RP118. (I



VIEW "A"

RC-2459

*COMPONENTS ADDED, DELETED OR CHANGED B

SERVICE SHEET

DESK MICROPHONES 19B209458P1 AND 19B209459P1

Issue 1

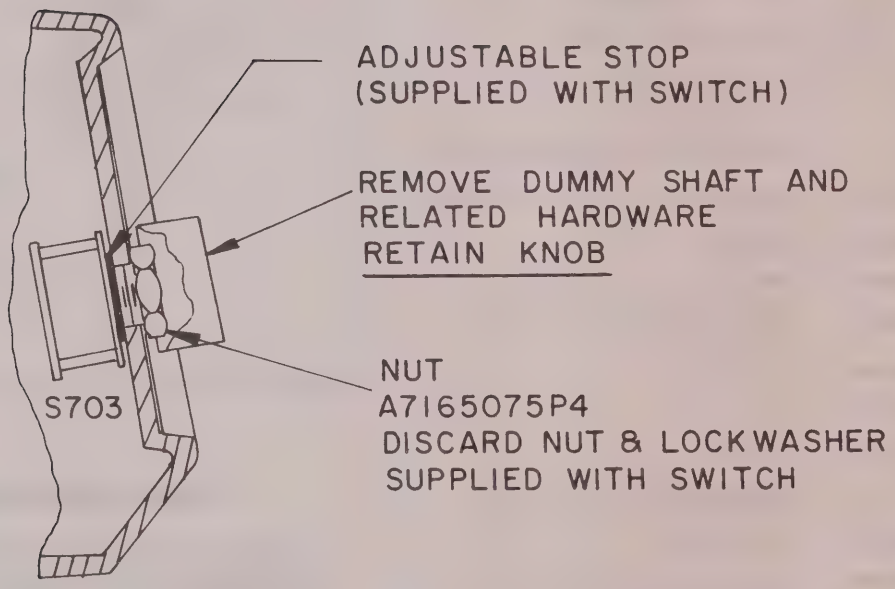
MULTI-FREQUENCY INSTALLATION

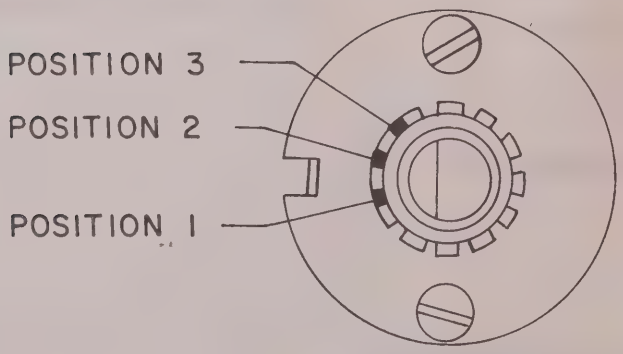
1. WHEN INSTALLING MULTI-FREQ., THE FOLLOWING MODIFICATIONS MUST BE PERFORMED:

   CUT THE BLUE WIRE OUT OF HARNESS (W401) FROM OSC/MULT TO I.F. DETECTOR BD.

   CUT THE ORANGE WIRE OUT OF HARNESS (W3) FROM J902-3 TO J903-5.

2. THE FREQUENCY SELECT SWITCH (S703) STOP IS TO BE SET TO CONFORM WITH THE DESIRED NUMBER OF FREQ.
   ROTATE SWITCH FULLY COUNTERCLOCKWISE.
   FOR 2 FREQ. SET STOP IN POSITION 1.
   FOR 3 FREQ. SET STOP IN POSITION 2.
   FOR 4 FREQ. SET STOP IN POSITION 3.





SWITCH (S703) VIEWED FROM SHAFT END (ENLARGED)

RC-2964

INSTALLATION INSTRUCTION

MULTI-FREQUENCY KIT 19C321954

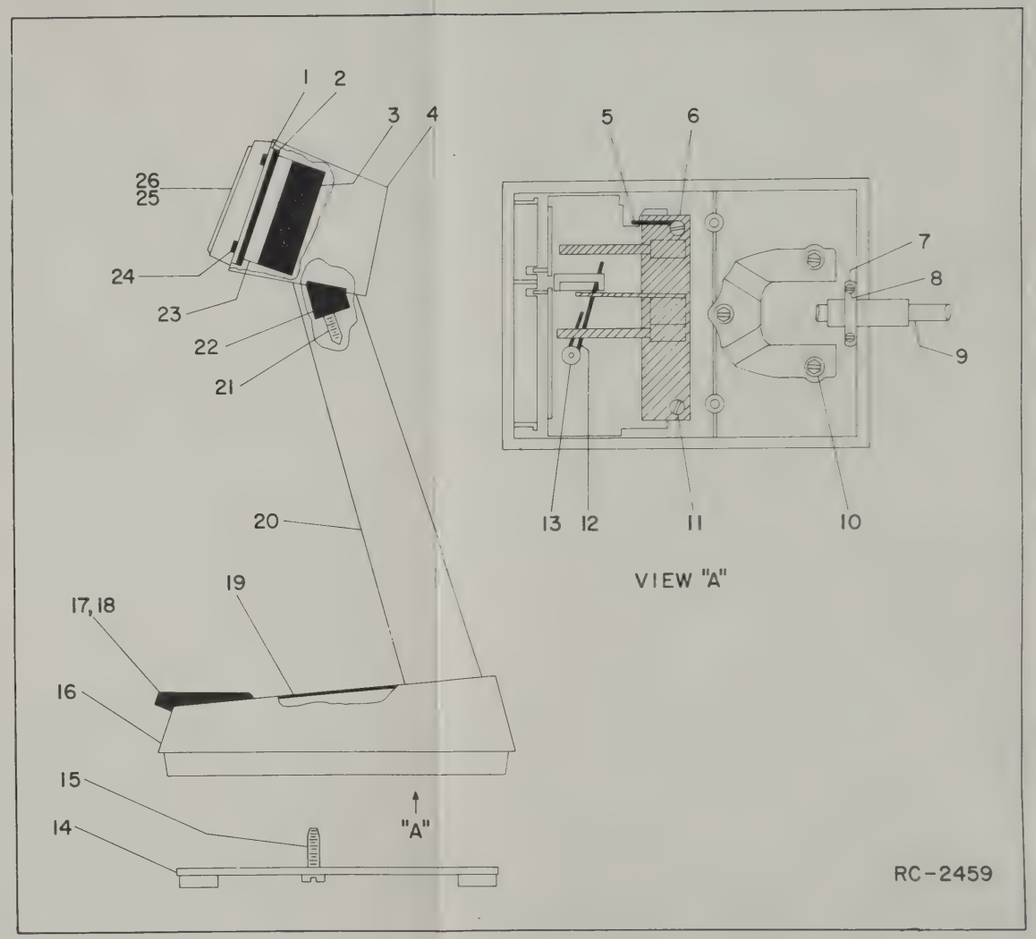
PARTS LIST

LBI-4473

DESK MICROPHONES
19B209458P1 (STANDARD)
19B209459P1 (CHANNEL GUARD)
(SEE RC-2459)

SYMBOL	GE PART NO.	DESCRIPTION
		STANDARD DESK MICROPHONE 19B209458P1
1		Locking plate. (Part of item 4).
2		Gasket. (Part of item 4).
3		"O" Ring. (Part of item 4).
4		Head Assembly. RP122. (Includes items 1-3, 24-26).
5		(Not Used).
6		Switch Kit. RP124. (Includes items 11, 17).
7		Retaining Bar. (Part of item 9).
8		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 9).
9		Cable Kit. RP123. (Includes items 7, 8).
10		Screw, thread forming, slotted: No. 8 x 3/4. (Part of item 20).
11		Screw, thread forming, slotted: No. 4 x 5/8. (Part of item 6).
12		(Not Used).
13		(Not Used).
14		Base plate. (Part of item 16).
15		Screw, thread forming, slotted: No. 8 x 3/4. (Secures Base Plate- Part of item 16).
16		Base Assembly. RP125. (Includes items 14, 15, 19).
17		Pushbutton, Transmit. (Part of item 6).
18		(Not Used).
19		Nameplate. (Part of item 16).
20		Stem Assembly. RP121.
21		Screw, thread forming, slotted: No. 8 x 1/2. (Part of item 20).
22		Clamp. (Secures Head Assembly to Stem Assembly- Part of item 20).
23		Transistorized Cartridge. RP117.
24		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 4).
25		Grille. (Part of item 4).
26		Dust cloth. (Part of item 4).
		CHANNEL GUARD DESK MICROPHONE 19B209459P1
1		Locking plate. (Part of item 4).
2		Gasket. (Part of item 4).
3		"O" Ring. (Part of item 4).
4		Head Assembly. RP122. (Includes items 1-3, 24-26).
5		Lock spring. (Part of item 6).
6		Switch Kit. RP119. (Includes items 5, 11, 12, 13, 17, 18).
7		Retaining Bar. (Part of item 9).
8		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 9).
9		Cable Kit. RP118. (Includes items 7, 8).
10		Screw, thread forming, slotted: No. 8 x 3/4. (Part of item 20).
11		Screw, thread forming, slotted: No. 4 x 5/8. (Part of item 6).
12		Spring. (Part of item 6).
13		Retainer. (Part of item 1).
14		Base plate. (Part of item 16).
15		Screw, thread forming slotted: No. 8 x 3/4. (Secures Base Plate- Part of item 16).
16		Base Assembly. RP120. (Includes items 14, 15, 19).
17		Pushbutton, Monitor. (Part of item 6).
18		Pushbutton, Transmit. (Part of item 6).
19		Nameplate. (Part of item 16).
20		Stem Assembly. RP121.
21		Screw, thread forming, slotted: No. 8 x 1/2. (Part of item 20).
22		Clamp. (Secures Head Assembly to Stem Assembly- Part of item 20).
23		Transistorized Cartridge. RP117.
24		Screw, thread forming, slotted: No. 4 x 1/2. (Part of item 4).
25		Grille. (Part of item 4).
26		Dust cloth. (Part of item 4).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SERVICE SHEET

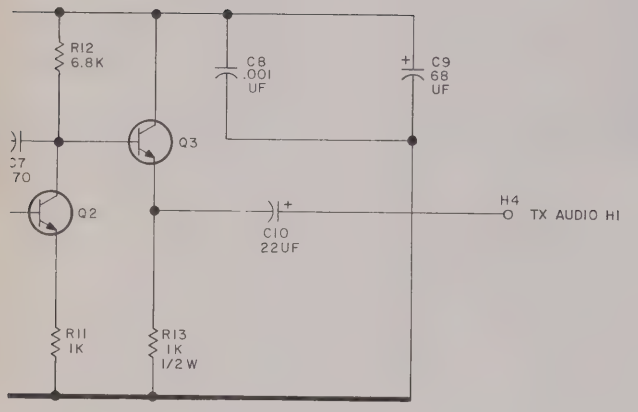
DESK MICROPHONES 19B209458P1 AND 19B209459P1

Issue 1

PARTS LIST

LBI-30374

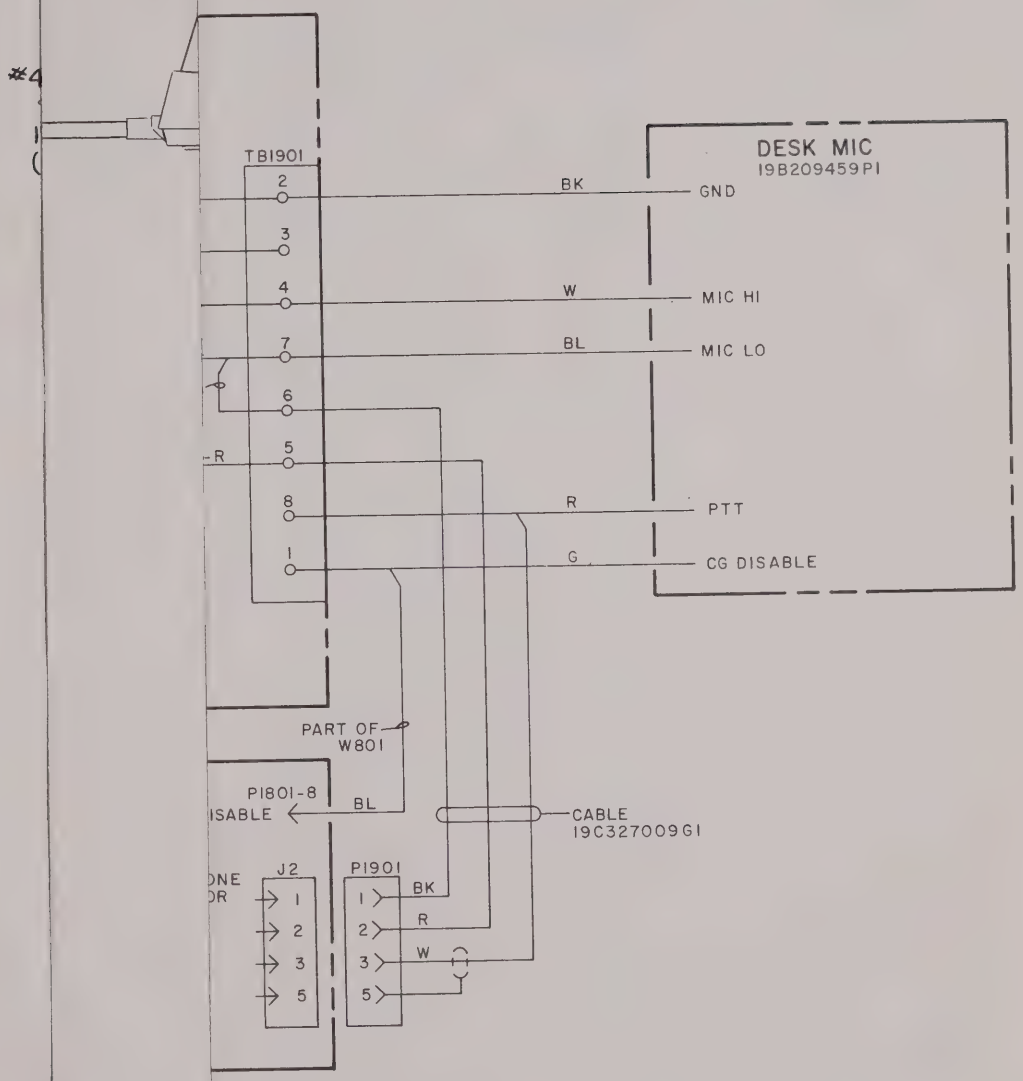
DESK MICROPHONE PRE-AMP KIT
19A136766G1



ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

SYMBOL	GE PART NO.	DESCRIPTION
A1901		PRE-AMP BOARD 19C327316G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C2	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C6	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap
C8	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1 thru Q3	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R2	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R3	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R4	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R5	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R6	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R7	19B209358P104	Variable, carbon film: approx 100 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R8	3R152P751J	Composition: 750 ohms ±5%, 1/4 w.
R9	3R152P154J	Composition: 150,000 ohms ±5%, 1/4 w.
R10	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R11	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R12	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R13	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1901	19B227521G1	Terminal board: 8 terminals.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B209260P103	Solderless terminal. (Terminates wires located at H1-H4).
	19B227523G1	Support. (A1901).
	19B201074P206	Tap screw, Phillips POZIDRIV®: No. 4-40 x 3/8. (Secures TB1901).
	N80P13003C6	Machine screw: No. 6-32 x 3/16. (Secures A1901).
	N80P13008C6	Machine screw: No. 6-32 x 1/2. (Secures clip loop).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Used with clip loop and A1901).
	N402P7C6	Flatwasher, steel: No. 2. (Used with clip loop).
	7141225P3	Hex nut: No. 6-32. (Secures clip loop).
	4029851P26	Clip loop. (Secures P1901 cable and desk mike cord).

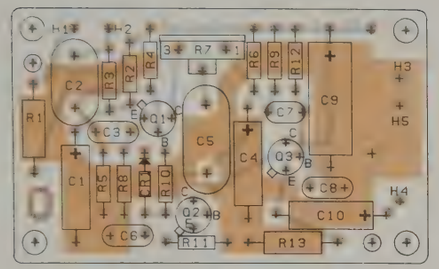
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



INSTALLATION INSTRUCTIONS

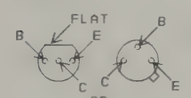
DESK MICROPHONE PRE-AMP KIT 19A136766

OUTLINE DIAGRAM



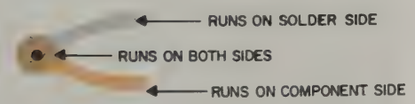
(19C327399, Rev. 0)
(19B227517, Sh. 1, Rev. 0)
(19B227517, Sh. 2, Rev. 0)

LEAD IDENTIFICATION
FOR Q1, Q2 & Q3

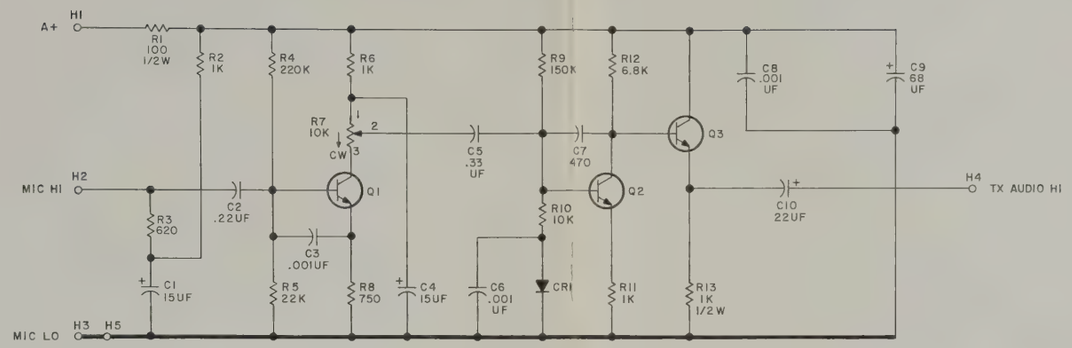


FROM	WIRE
H1	SF22O
H2	SF22W
H3	SF22BL
H4	SF22R

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



SCHEMATIC DIAGRAM



THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PL19C327316	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

(19D424129, Rev. 1)

PARTS LIST

LBI-30374

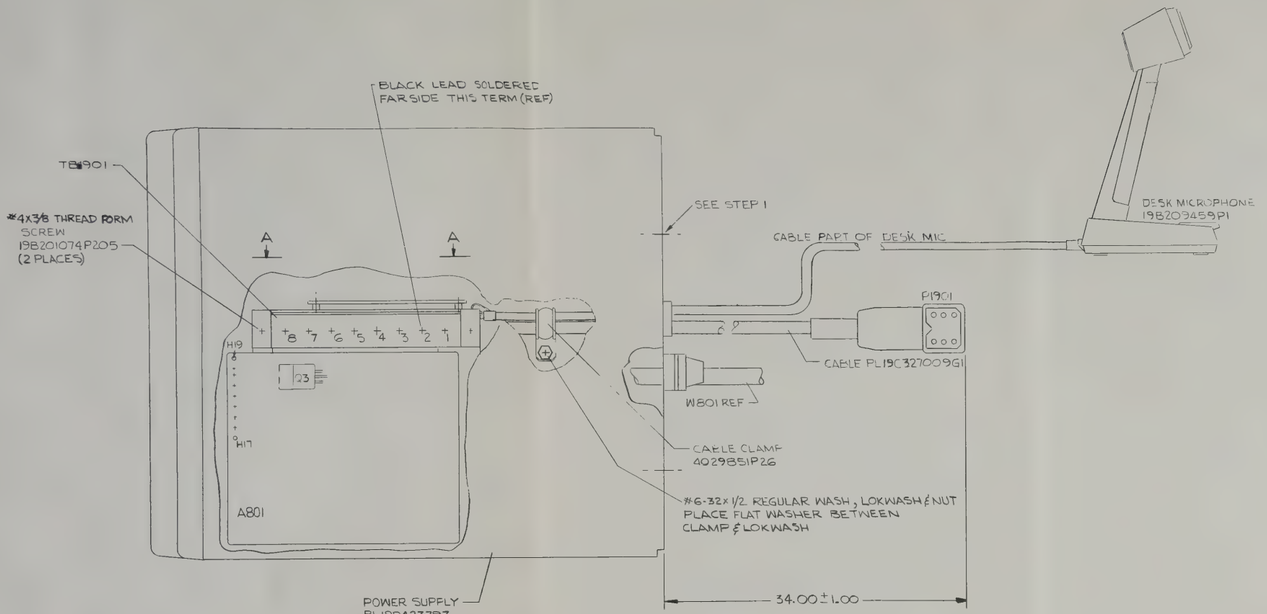
DESK MICROPHONE PRE-AMP KIT
19A136766G1

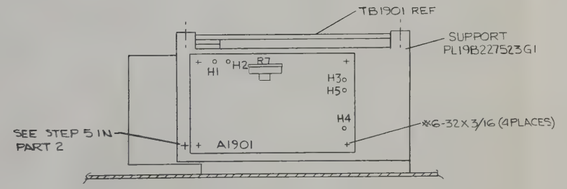
SYMBOL	GE PART NO.	DESCRIPTION
A1901		PRE-AMP BOARD 19C327316G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C2	19A116080P9	Polyester: 0.22 µf ±20%, 50 VDCW.
C3	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C4	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C5	19A116080P10	Polyester: 0.33 µf ±20%, 50 VDCW.
C6	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C7	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap
C8	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1 thru Q3	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R2	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R3	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R4	3R152P224J	Composition: 220,000 ohms ±5%, 1/4 w.
R5	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R6	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R7	19B209358P104	Variable, carbon film: approx 100 to 2500 ohms ±10%, 0.2 w; sim to CTS Type X-201.
R8	3R152P751J	Composition: 750 ohms ±5%, 1/4 w.
R9	3R152P154J	Composition: 150,000 ohms ±5%, 1/4 w.
R10	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R11	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R12	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R13	3R77P102J	Composition: 1000 ohms ±5%, 1/2 w.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1901	19B227521G1	Terminal board: 8 terminals.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B209260P103	Solderless terminal. (Terminates wires located at H1-H4).
	19B227523G1	Support. (A1901).
	19B201074P206	Tap screw, Phillips POZIDRIV®: No. 4-40 x 3/8. (Secures TB1901).
	N80P13003C6	Machine screw: No. 6-32 x 3/16. (Secures A1901).
	N80P13008C6	Machine screw: No. 6-32 x 1/2. (Secures clip loop).
	N404P13C6	Lockwasher, internal tooth: No. 6. (Used with clip loop and A1901).
	N402P7C6	Flatwasher, steel: No. 2. (Used with clip loop).
	7141225P3	Hex nut: No. 6-32. (Secures clip loop).
	4029851P26	Clip loop. (Secures P1901 cable and desk mike cord).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SERVICE SHEET

DESK MICROPHONE PRE-AMP KIT
19A136766G1





VIEW A-A

(19D424152, Rev. 0)

THIS INSTRUCTION COVERS THE FACTORY INSTALLATION OF DESK MICROPHONE PREAMP OPTION TO THE CUSTOM MVP STATION

1. REMOVE COVER OF CUSTOM MVP POWER SUPPLY BY REMOVING FOUR (4) SCREWS AT REAR OF UNIT. (SAVE COVER AND SCREWS)
2. MOUNT COMPONENT BOARD, A1901, TO SUPPORT, PL19B227523G1, USING FOUR (4) #6-32 X 3/16 SCREWS AND LOCKWASHERS SUPPLIED. (SEE VIEW A-A)
3. POSITION TERMINAL BOARD, TB1901, AND COMPONENT BOARD SUPPORT AS SHOWN IN VIEW A-A, AND ATTACH WITH TWO (2) #4 X 3/8 THREAD FORMING SCREWS SUPPLIED.
4. MAKE THE FOLLOWING CONNECTIONS:

FROM	COLOR	TO		
TB1901-2	BK	A801-H17	SOLDER	CONNECT WIRES TO SOLDER SIDE
TB1901-3	O	A801-H19	SOLDER	
A1901-H1	O	TB1901-3		
A1901-H2	W	TB1901-4		
A1901-H3	BL	TB1901-7		
A1901-H4	R	TB1901-5		

5. REMOVE INSULATING SLEEVING AND TERMINATE BLUE LEAD FROM W801 TO TB1901-1.
6. MOUNT CABLE CLAMP 4029851P26 IN PLACE.
7. REPLACE COVER AND SCREWS SAVED FROM STEP 1.

THIS INSTRUCTION COVERS THE FIELD INSTALLATION OF THE DESK MICROPHONE PREAMP TO THE CUSTOM MVP STATION.

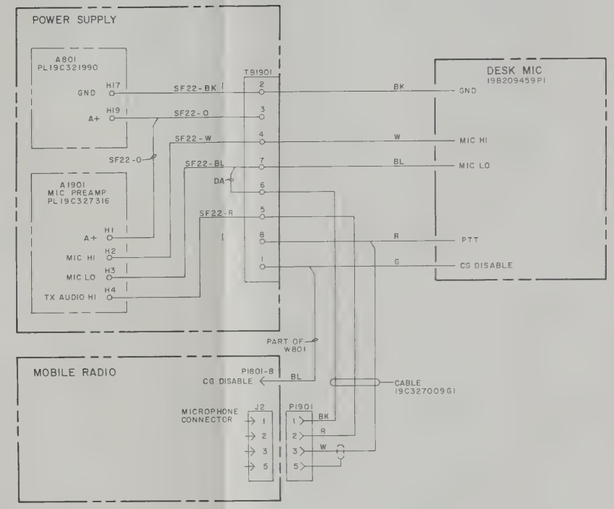
1. REMOVE COVER OF CUSTOM MVP POWER SUPPLY BY REMOVING FOUR (4) SCREWS AT REAR OF UNIT. (SAVE COVER AND SCREWS)
2. INSTALL PREAMP BOARD FOLLOWING STEPS 2 THRU 5 IN PART 1.
3. PASS MIC CABLE THRU COVER THEN ROUTE DESK MIC AND P1901 CABLES THROUGH EYELET IN REAR OF POWER SUPPLY.
4. MAKE THE FOLLOWING CONNECTIONS USING CABLE PL19C327009G1:

FROM	COLOR	TO
P1901-1	BK	TB1901-6
P1901-2	R	TB1901-5
P1901-3	W	TB1901-8

5. MAKE THE FOLLOWING CONNECTIONS USING DESK MIC CABLE:

COLOR	TO
BK	TB1901-2
W	TB1901-4
BL	TB1901-7
R	TB1901-8
G	TB1901-1

6. INSERT DESK MIC CABLE STRAIN RELIEF HOOK IN HOLE ON COMPONENT BOARD SUPPORT AND PINCH CLOSED.
7. ROUTE BOTH MIKE CABLE AND P1901 CABLE THROUGH CABLE CLAMP AND SECURE TO POWER SUPPLY WITH HARDWARE SUPPLIED.
8. REPLACE COVER AND SCREWS SAVED FROM STEP 1.
9. CONNECT P1901 TO J2 (MICROPHONE JACK) ON MOBILE RADIO.



(19C327324, Rev. 1)

INSTALLATION INSTRUCTIONS

DESK MICROPHONE PRE-AMP KIT
19A136766

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model Number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

PRINTED IN U.S.A.

MOBILE RADIO

MASTR CUSTOM MVP MAINTENANCE MANUAL

SYSTEM-AUDIO-SQUELCH BOARD, CONTROL PANEL, MULTI-FREQ. KIT

SPECIFICATIONS *

INPUT VOLTAGE	13.0 Volts DC ±20% (RX) 13.2 Volts DC ±20% (TX)
OUTPUT VOLTAGE	Regulated 10 Volts DC ±0.1 VDC at 0.1 to 0.5 Amperes
MAXIMUM CURRENT DRAIN (at 13.8 VDC)	0.25 Amperes (Squelched) 0.70 Amperes (Unsquelched)
AUDIO OUTPUT	3.0 Watts at less than 5% Distortion

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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2 PPM Oscillator Board 19C327107G1 8

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INSTALLATION INSTRUCTION

Multi-Frequency Kit 19C321954 20

WARNING

Although the highest DC voltage in MASTR Custom MVP Mobile Equipment is supplied by the vehicle battery, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits! High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

DESCRIPTION

The System-Audio-Squelch Board for the MASTR Custom MVP radio mounts on the front of the system frame behind the front control panel assembly. Molex connectors are provided on the board to provide interconnection with other modules and options. The microphone jack connects into the system harness between the System-Audio-Squelch (SAS) Board and the system connector (J1) at the rear of the radio. The Carrier Control Timer (option 1907) connects directly to the SAS board. The Channel Guard board or Carrier Defeat Timer (Option 1908) connects to the SAS board be means of a harness.

The SAS board contains a hybrid 10-Volt Regulator IC, a hybrid Squelch Module IC and a monolithic 3-Watt audio amplifier circuit. An active filter de-emphasis network is also provided in the audio circuit.

The Control Panel assembly is located on the front cap of the radio. An ON-OFF-VOLUME control, a squelch and Channel Guard MONITOR slide switch, a red transmit indicator Light Emitting Diode (LED), and a frequency control switch (on multi-frequency radios) are provided on the Control Panel. A harness, terminated with a 7-pin connector, connects these controls to the System-Audio-Squelch Board.

CIRCUIT ANALYSIS

10-Volt Regulator IC

The 10-Volt Regulator IC contains the following circuits:

- 10-Volt Regulator Reference Amplifiers
- Receiver Muting and Delay
- Transmitter Keying and Delay
- Receiver Oscillator Control
- Transmitter Disable

The 10-Volt Regulator includes regulator amplifier transistors in the IC (U902) and regulator pass transistor Q905. The regulator circuit provides a closely-controlled supply voltage for the transmitter exciter and the receiver, as well as for Channel Guard and Carrier Control Timer options when used.

Turning on the radio with ON-OFF switch S701 applies voltage (A+) from the battery (in mobile combinations) or the AC power supply (when the station option is used) to pin 1 of IC U902. The regulator amplifier output at pin 2 of U902 is applied to the base of Q905, causing Q905 to conduct. The voltage at the collector of Q905 and pin 3 of U902 is the regulated 10 Volts output.

Receive Function

When the radio is in the receive mode, the transmitter oscillator control switch in the regulator IC U902 is turned off and the receiver oscillator control switch is turned on. The 10-Volt output of this switch is connected through pin 7 of U902 to the receiver oscillator control circuits.

VOLUME/SQUELCH HI from the IF/DETECT module is connected via the VOLUME control (R701) to the audio amplifier on the SAS board. The active filter (Q904) and de-emphasis network provide a 6 dB/Octave frequency response. The audio from the filter is applied to the monolithic amplifier AR901. This amplifier is supplied in a modified 16 lead quad-in-line package with wing-tab heat sinks. The amplifier provides 3-Watts output to the speaker.

When Channel Guard is used, the filter located on the Channel Guard module connects in series with the VOLUME control arm (by removing the jumper between H1 and H2 on the SAS board) and the input to the de-emphasis network. The Channel Guard filter provides a minimum of 17 dB attenuation of the CG tone frequencies.

Squelch Control Circuit

The hybrid squelch IC (U901) uses a custom flip-chip monolithic integrated circuit. The squelch IC contains the noise amplifier, active noise filter, detector, and the slow squelch circuit.

Noise from the IF/DET is coupled through the fixed squelch adjust control R901 to pin 1 of U901. This signal is applied to the noise amplifier and then to the active filter circuit.

The noise amplifier and active filter provide the gain and selectivity to distinguish between noise and audio. The filter output drives the active detector circuit to provide the squelch switching functions. Thermistor RT601 keeps the input to the active detector constant over wide variations in temperature. The slow squelch circuit provides a 200 millisecond squelch operation to prevent rapid squelch opening and closing in weak signal areas.

The squelch switch output at pin 7 of U901 is connected to the receiver mute control circuit. When the receiver is squelched the output at pin 7 is near A-. This keeps Q902 turned off, allowing Q903 to conduct. Conduction of Q903 applies a low to pin 7 of AR901, turning the amplifier off and muting the receiver. When the receiver is quieted by an on-frequency signal (unsquelches), the voltage at pin 7 of U901 rises to approximately +10 Volts. This turns on Q902, preventing Q903 from conducting. The resulting high at pin 7 of AR901 turns on the amplifier and audio is heard at the speaker.

With the receiver unsquelched, the output of the squelch switch turns on the RUS switch. The output of the RUS switch is connected to the noise amplifier, providing a hysteresis loop in the squelch circuit. The RUS output increases the gain of the noise amplifier, preventing squelch closing on weak signals.

NOTE

In Channel Guard radios, the squelch circuit will operate only when an on-frequency signal with the correct Channel Guard tone is applied to the receiver.

Squelch Disable

Placing the Squelch switch S702 (located on the Control Panel) in the TEST position applies bias to the base of Q901 on the SAS board. The transistor is operated. Conduction of Q901 operates Q902, grounding the base of Q903 and preventing it from operating. As long as this condition remains, the squelch circuit is disabled. In Channel Guard radios, moving the Squelch switch S702 to the MON position applies ground to the CG DISABLE circuit on the Channel Guard board. This results in removing the low on the RX MUTE lead at J906-5 and the base of Q902, enabling the squelch circuit.

Transmitter Keying and Delay

Pressing the PTT (TRANSMIT) switch on the microphone connects pin 8 of U902 to A-. Capacitor C924 starts to charge. In 20 milliseconds C924 is charged to a voltage high enough to allow the time delay switch in U902 to turn on. This causes the transmitter oscillator control switch in U902 to turn on. +10 Volts is applied via pin 14 of U902 to the transmitter oscillator, keying the transmitter. The voltage at pin 7 of U902 goes low under these conditions, removing the receiver oscillator control voltage.

The 20 millisecond time delay in the transmitter oscillator keying circuit allows the antenna relay to energize before RF is applied to the relay.

Operating the PTT switch turns on the receiver muting and delay circuit in U902, applying A- to pin 6. Q902 is now prevented from operating, muting the receiver. C923 starts to charge from the +10-Volt line. When the PTT switch is released, C923 keeps the A- voltage at pin 6 for approximately 50 milliseconds. This delays the turn-on of the receiver audio at the end of a transmission.

Transmitter Disable

In radios equipped with a Carrier Control Timer, pin 11 of U902 connects to the TX DISABLE lead of the Carrier Control Timer. When the timing cycle on the timer runs out, A- is applied to pin 11, turning off the transmitter oscillator control voltage which turns off the transmitter.

CRYSTAL MODULE (5 PPM Oscillator)

Crystal modules determine the operating frequency of the transmitter and receiver. The plug-in module contains a crystal, a trimmer capacitor and a varicap temperature compensation.

The quartz crystal used in the crystal module exhibits the traditional "S" curve characteristics of output frequency versus operating temperature as shown in Figure 1. In the mid-temperature range (-10°C to +50°C), the raw crystal characteristics are maintained. The compensation voltage which drives the crystal module varicap is approximately constant over this temperature range; consequently, the crystal almost solely determines the temperature characteristics. The crystals whose temperature characteristics lie toward the high limit of +4 parts per million (PPM) are rotated slightly. All others have little to no rotation.

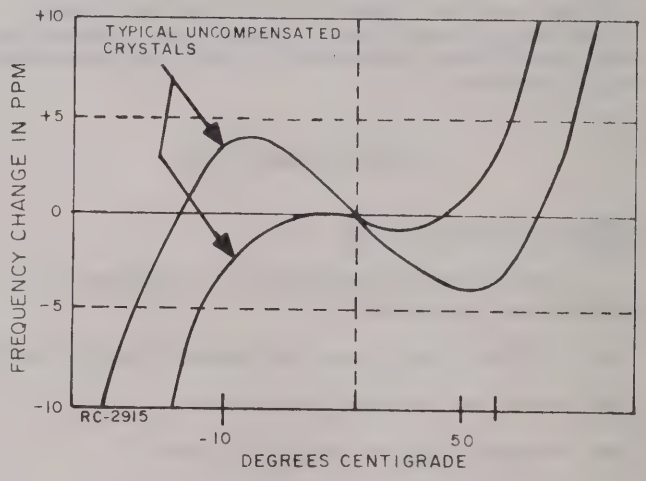


Figure 1 - Crystal Characteristics

The cold end temperature characteristic is "lifted" by a temperature-dependent increasing voltage. The compensator which drives the crystal module varicap produces a voltage which increases linearly from -10°C to -30°C. This voltage decreases the varicap capacity which, in turn, increases the module tuned circuit frequency to compensate for the decreasing frequency characteristics of the crystal.

The hot end crystal temperature characteristic shown in Figure 1 is increasing with temperature. Above 50°C, the hot end crystal characteristic is compensated for by a decreasing voltage from the compensator. This results in added capacity from the varicap, decreasing the module frequency to counteract the increasing frequency response of the crystal.

Compensation voltage from the exciter is applied to pin 4 of the crystal modules to maintain frequency stability within 5 parts-per-million (PPM) over a temperature range of -30°C to +60°C.

SERVICE NOTE

Proper crystal module operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should all of the crystal modules shift off-frequency, check the 10-Volt regulator.

The compensation voltage varies non-linearly with temperature to complement the temperature/frequency characteristics of the crystal. Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules, as measured with a high impedance meter.

	OUTPUT VOLTAGE	
TEMPERATURE RANGE	MINIMUM	MAXIMUM
-30°C	4.9 Volts	6.0 Volts
-10° to +50°C	3.7 Volts	4.3 Volts
75°C	3.3 Volts	3.8 Volts

Trimmer capacitor C3 is used to adjust the radio for the exact operating frequency. Refer to the applicable Alignment Procedure for details.

Operating voltage for the crystal module is supplied from the Tx or Rx OSC control circuit on the SAS board or through the biased PIN diode on the multi-frequency board to pin 1 of the selected crystal module.

Multi-Frequency Kit (5 PPM Oscillators)

The Multi-Frequency Kit is provided in radios with more than one operating frequency. It contains the necessary circuitry to provide three additional transmit and three additional receive frequencies to the standard radio. The multi-frequency board utilizes crystal modules to determine the exact operating frequencies.

The transmit and receive oscillator circuits are identical, each using a single transistor in conjunction with the selected crystal module to comprise the oscillator circuit. Crystal modules are selected for operation by the frequency select lead from the control panel. PIN diodes are used to switch the output of the selected crystal module to the base of the appropriate transistor, Q2601 (receive) and Q2602 (transmit).

Since the oscillator circuits are identical, only the F2 circuits are described here. When F2 is selected by S703 at the control panel, A- is applied to the junction of R2603 and R2606 and to the junction of C2608 and R2611. PIN diodes CR2601 and CR2604 are now forward biased, applying the output of the crystal modules (pin 1) to the base of the common oscillator transistors Q2601 and Q2602. The selected crystal modules (Y2601 and Y2604) and transistor circuits comprise two Colpitts oscillators.

The oscillator control voltage, required for transmit oscillator operation, is controlled by the transmit keying and delay circuits on the SAS board. Pressing the PTT switch applies the transmit oscillator control voltage (+10 VDC) to the emitter-base circuit of Q2602, causing it to oscillate at the assigned F2 crystal frequency.

A plug-in coaxial cable (W2602) connects the output of the oscillator to J102 on the exciter board. When the PTT switch is released, the transmit oscillator control voltage is removed from Q2602 and the anode of CR2604. Q2602 stops oscillating, removing the input to the exciter.

When the PTT switch is released, the receive oscillator control voltage from the keying and delay circuit on the SAS board is applied to the emitter-base circuit of Q2601. Since the transmit and receive modules are selected simultaneously, Q2601 now oscillates at the F2 receive crystal frequency and provides an output to J401 on the receive OSC/MULT board through cable W2601.

When a different frequency is selected, A- is removed from the junction of R2603-R2606 and the junction of R2611-C2608. This reverse biases PIN diodes CR2601 and CR2604, removing the crystal module outputs from the base circuits of the oscillators.

Compensator Circuit

The crystal modules on the Multi-Frequency Board are temperature compensated at both ends of the temperature range to provide instant frequency compensation. The temperature compensator is located on the transmitter exciter.

2 PPM UHF Transmit Oscillator Board

In those applications requiring 2 PPM UHF transmitter frequency stability, the 19C327107G1 Oscillator Board is required. This board accomodates one Integrated Circuit Oscillator Module (ICOM). The ICOM is enclosed in a dustproof, RF shielded can with the type (2C-ICOM) printed on top of the can. The 2C-ICOM contains an oscillator and a 2 PPM (±0.0002%) compensator IC.

Access to the oscillator trimmer is accomplished by prying up the plastic tab on the top of the can. The tabs can also be used to pull the ICOM out of the radio.

The output of the ICOM oscillator is connected through cable W2102 to the XY101 position on the transmitter exciter board.

The 2C-ICOM is temperature compensated at both ends of the temperature range to provide instant frequency compensation.

The cold end compensation circuit does not operate at temperatures above 0°C. When the temperature drops below 0°C, the circuit is activated. As the temperature decreases, the equivalent resistance decreases and the compensation voltage increases.

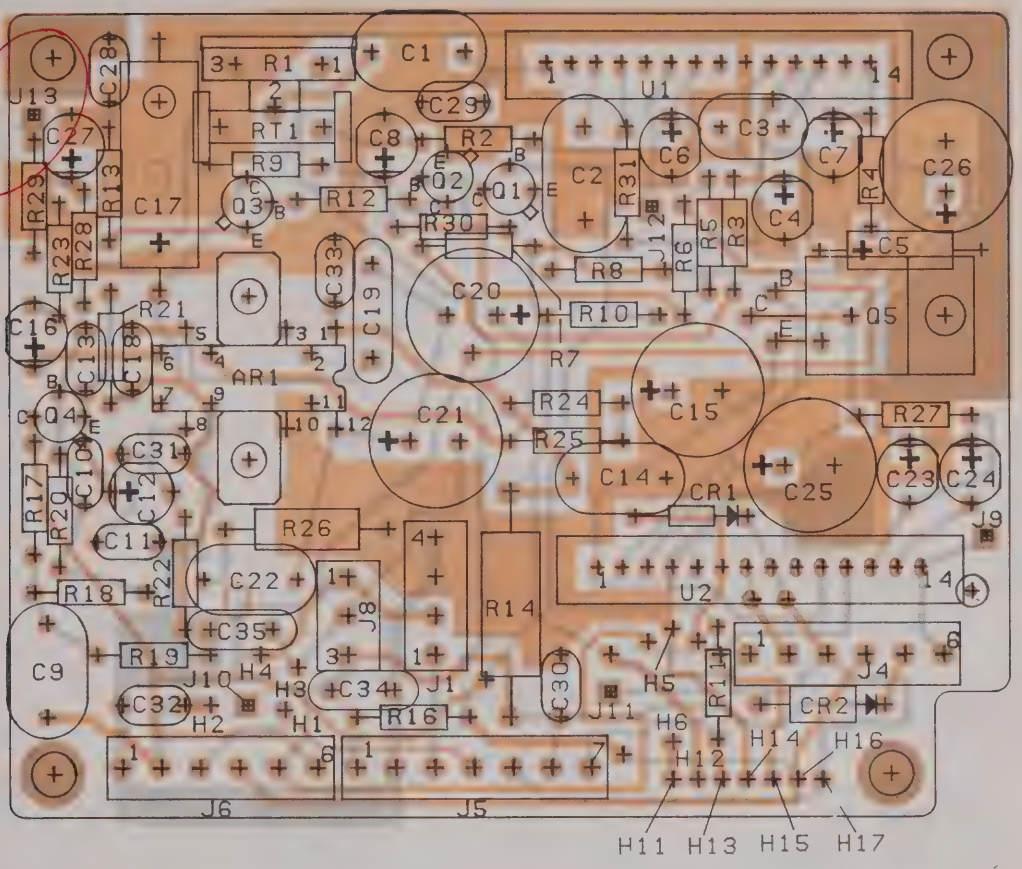
The increase in compensation voltage decreases the capacity of the varactor in the oscillator, increasing the output frequency of the ICOM.

The hot end compensation circuit does not operate at temperatures below +55°C. When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the equivalent resistance decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the ICOM.

SERVICE NOTE

Proper ICOM operation is dependent on the closely-controlled input voltages from the 10-Volt regulator. Should the ICOM shift off frequency, check the 10-Volt regulator or the output of the ICOM.

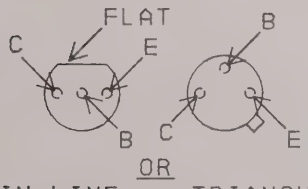
913 MIC BIAS



(19C327101, Rev. 0)
(19B227189, Sh. 2, Rev. 0)
(19B227189, Sh. 3, Rev. 0)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR COMPLETE DESIGNATION PREFIX WITH 900 SERIES.
EXAMPLE: C1-C901 , R1-R901 , ETC.

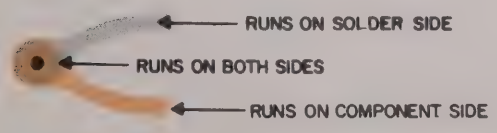
LEAD IDENTIFICATION
FOR Q1-Q4



TOP VIEW

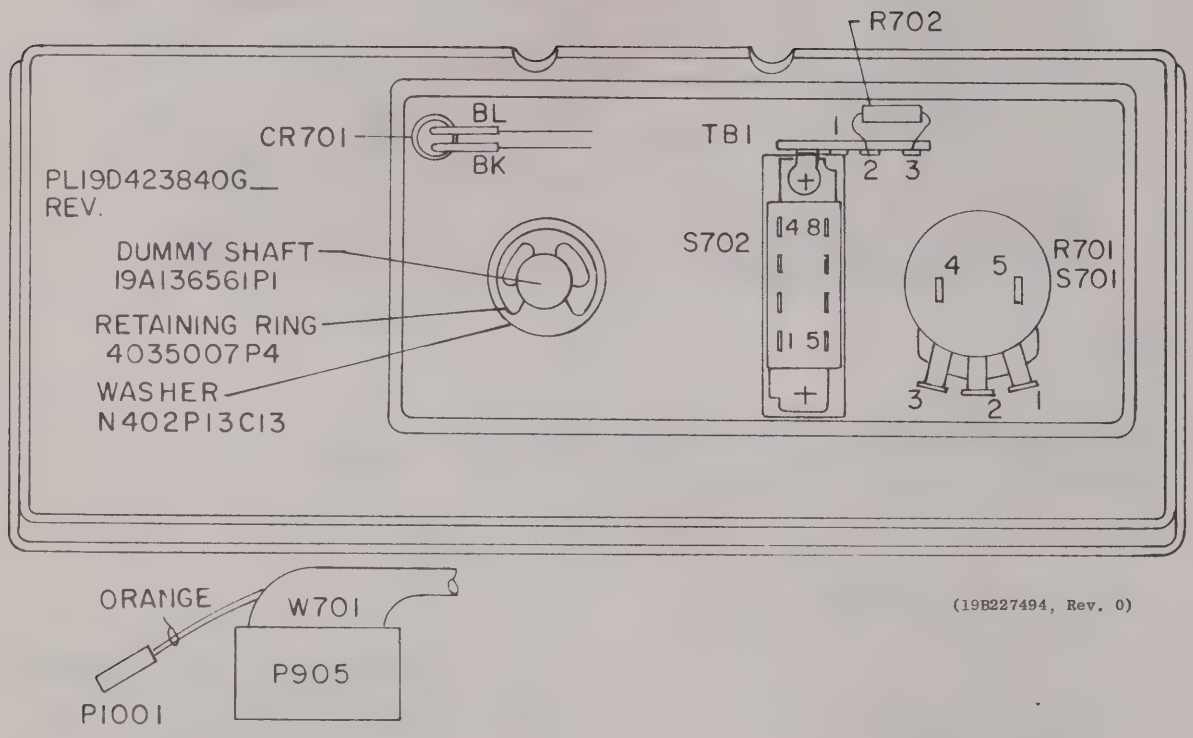
NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

REFER TO WIRING DIAGRAM 19D423734 FOR THE FOLLOWING CONNECTIONS	
FROM	TO
H1	H2
H3	H4



OUTLINE DIAGRAM

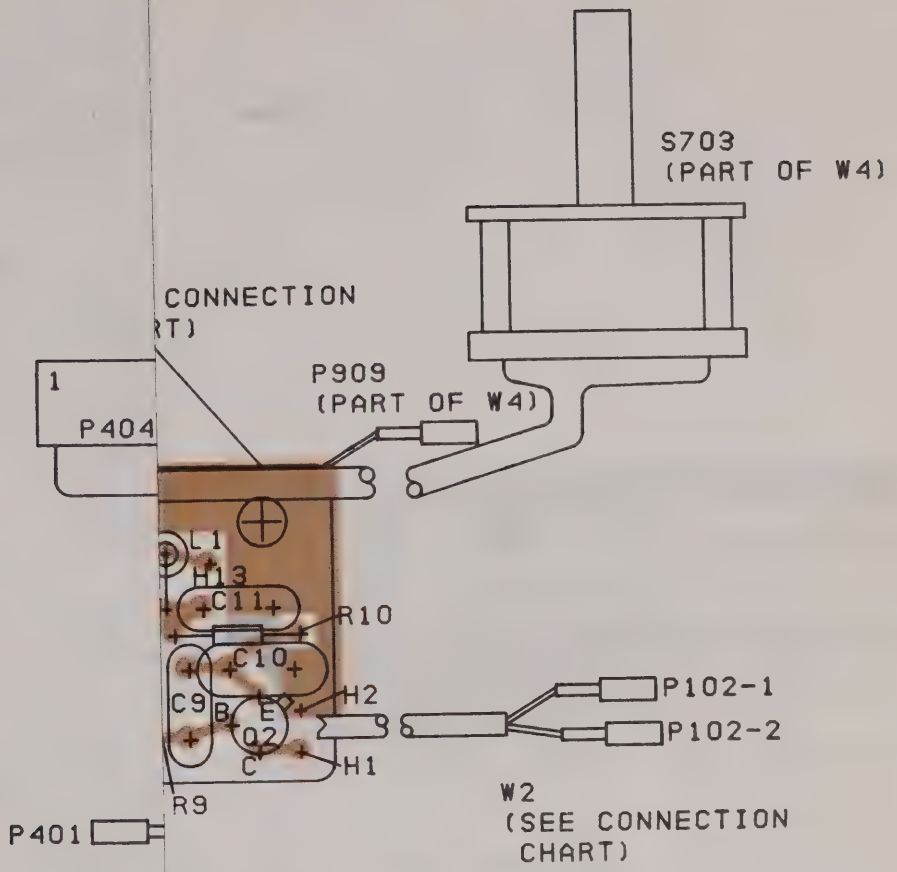
SYSTEM-AUDIO-SQUELCH BOARD
19C321920G1



(19B227494, Rev. 0)

OUTLINE DIAGRAM

CUSTOM MVP CONTROL PANEL
19D423840G1



0)
, Rev. 0)
, Rev. 0)

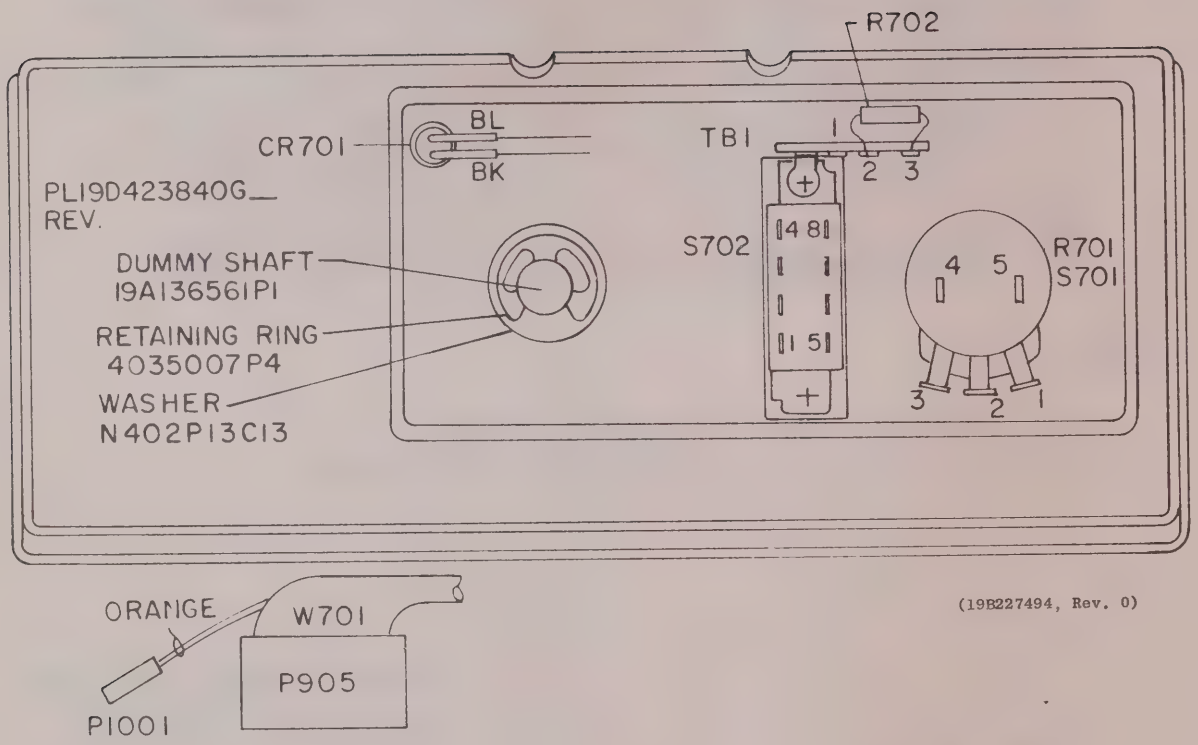
— RUNS ON SOLDER SIDE

BOTH SIDES

— RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

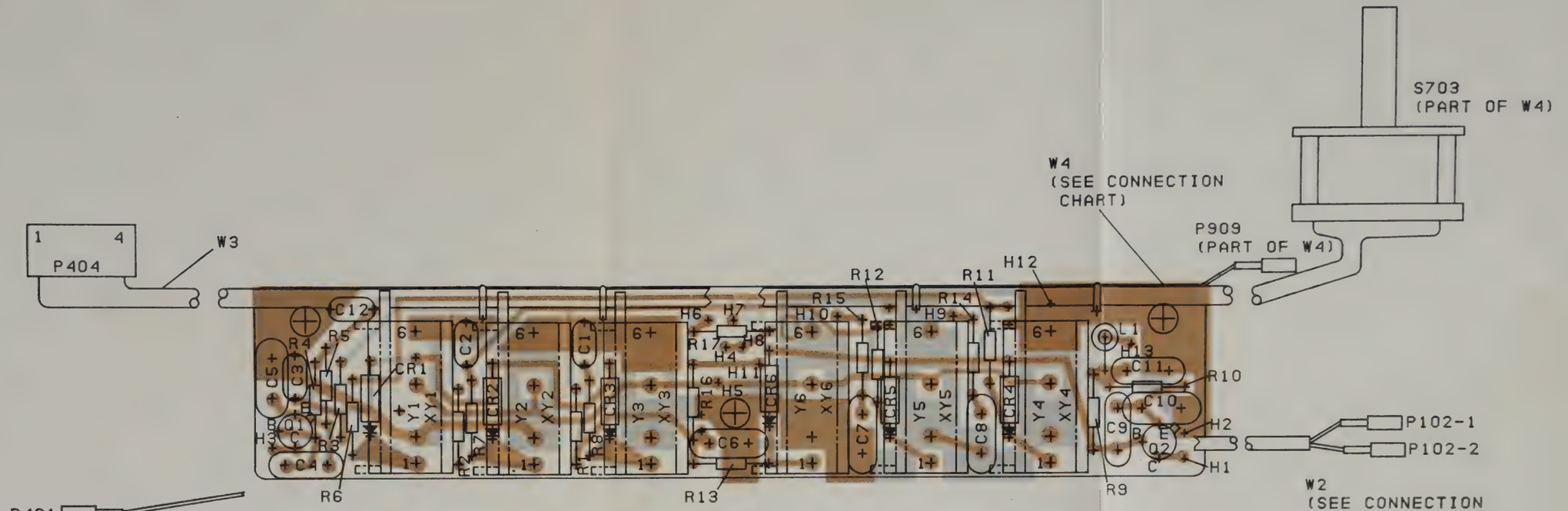
MULTI-FREQUENCY KIT
19C321954G1 & G2



(19B227494, Rev. 0)

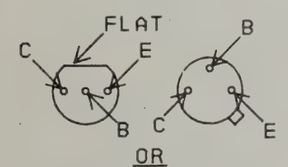
OUTLINE DIAGRAM

CUSTOM MVP CONTROL PANEL
19D423840G1



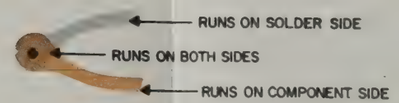
CONNECTION CHART		
WIRE	TO	REMARKS
W1	H3	
W2	H1	CENTER COND
W2	H2	SHIELD
W3-W	H7	
W3-R	H6	
W3-BL	H5	
W3-BR	H4	
W4-BR	H8	
W4-R	H9	
W4-O	H10	
W4-Y	H11	
W4-BK	H12	
W4-G	H13	

LEAD IDENTIFICATION
FOR Q1 AND Q2



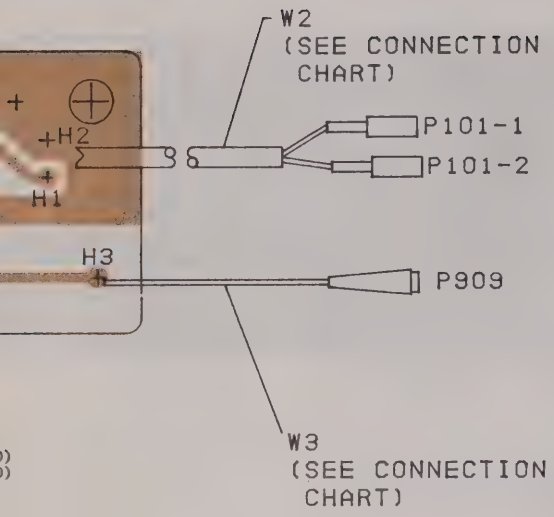
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

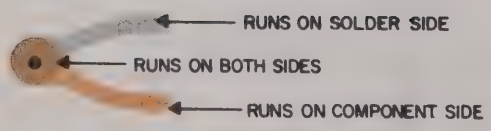


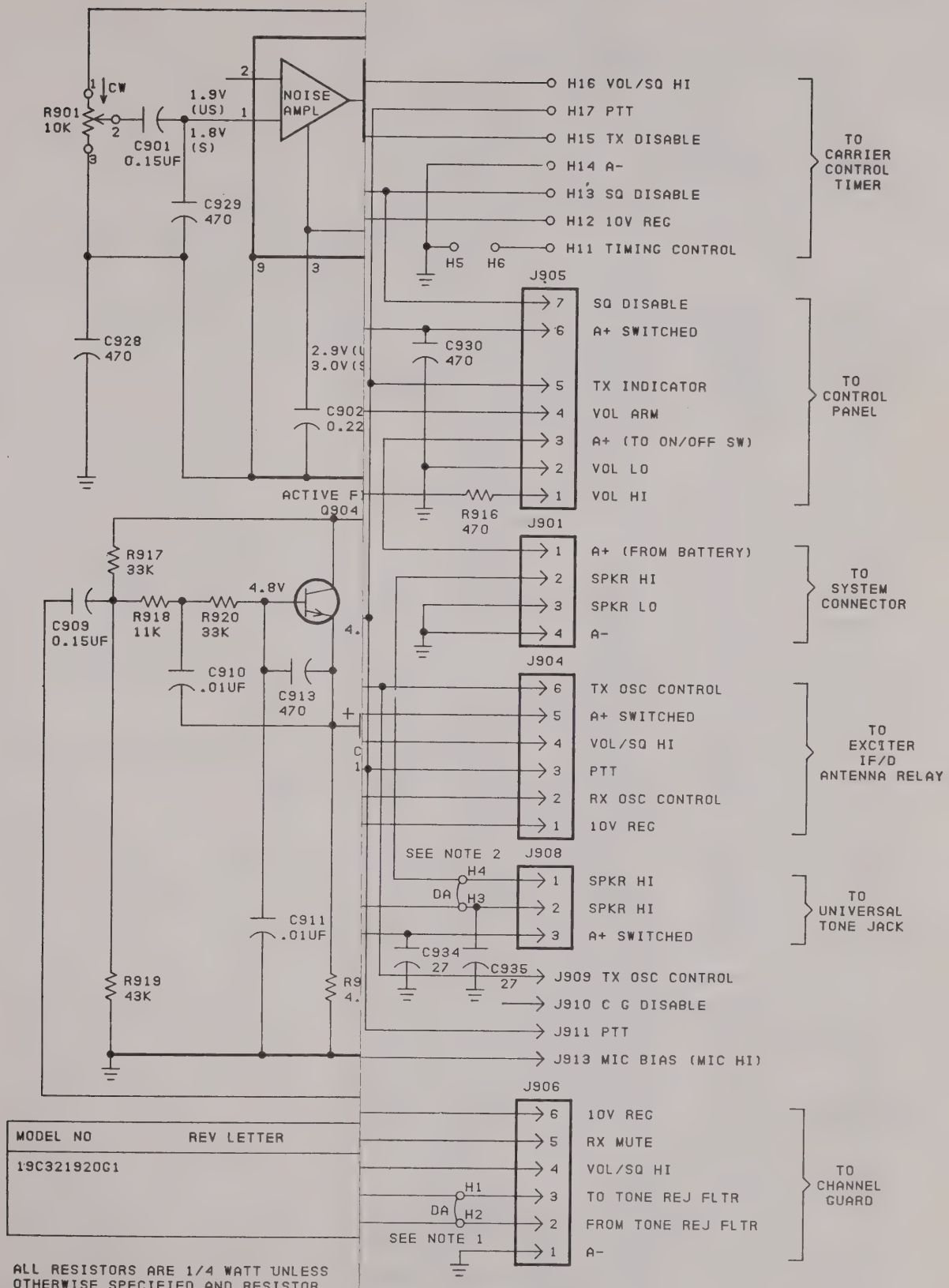
OUTLINE DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 2100 SERIES
EXAMPLE: C1-C2101, R1-R2101...ETC.



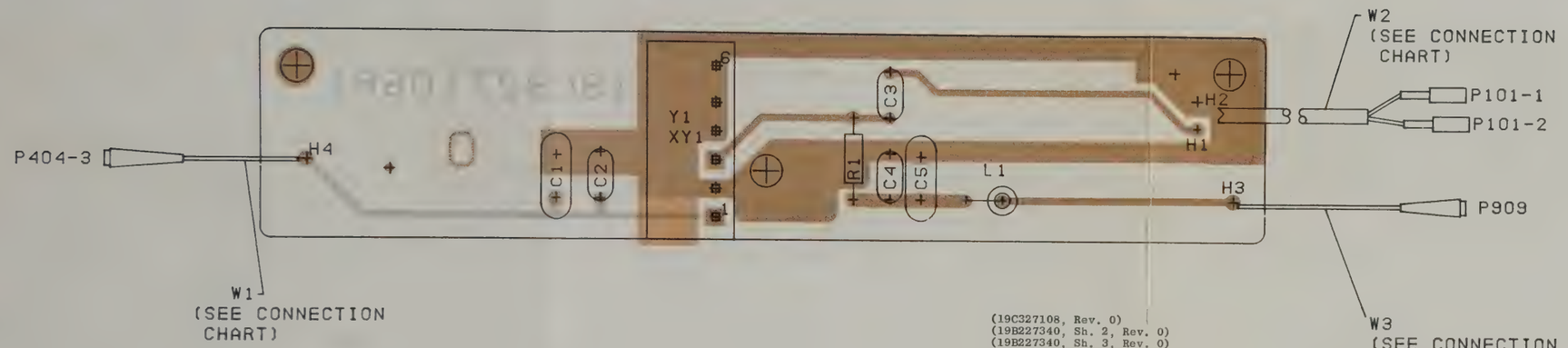


MODEL NO	REV LETTER
19C321920G1	

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUA TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS.

SCHEMATIC DIAGRAM

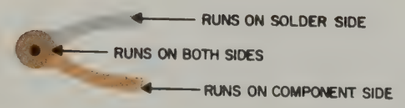
SYSTEM-AUDIO-SQUELCH BOARD 19C321920G1



(19C327108, Rev. 0)
(19B227340, Sh. 2, Rev. 0)
(19B227340, Sh. 3, Rev. 0)

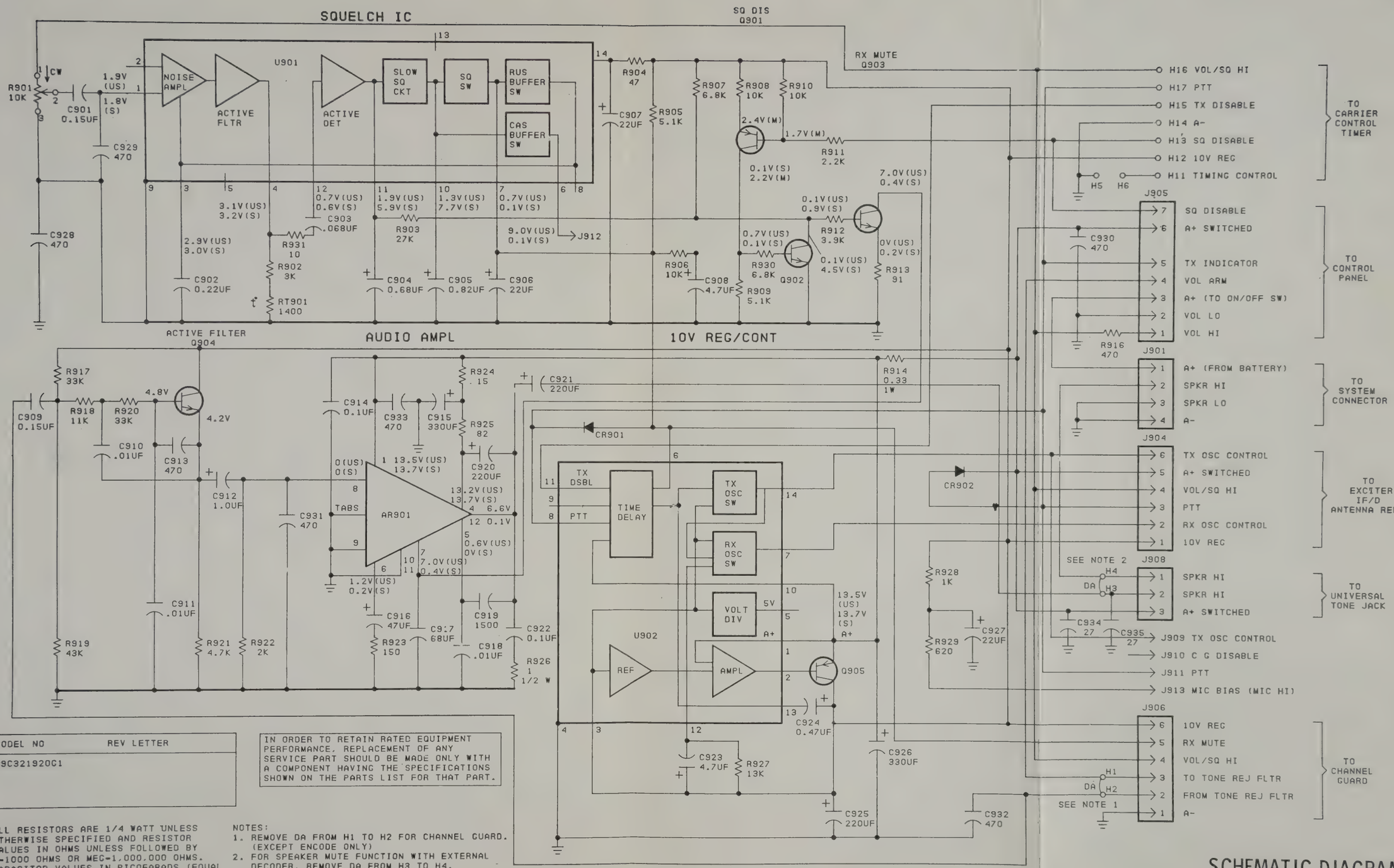
CONNECTION CHART		
WIRE	TO	REMARKS
W1	H4	
W2	H1	CENTER COND
W2	H2	SHIELD
W3	H3	

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 2100 SERIES
EXAMPLE: C1-C2101, R1-R2101...ETC.



OUTLINE DIAGRAM

2 PPM OSCILLATOR BOARD
19C327107G1



MODEL NO	REV LETTER
19C321920G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS.

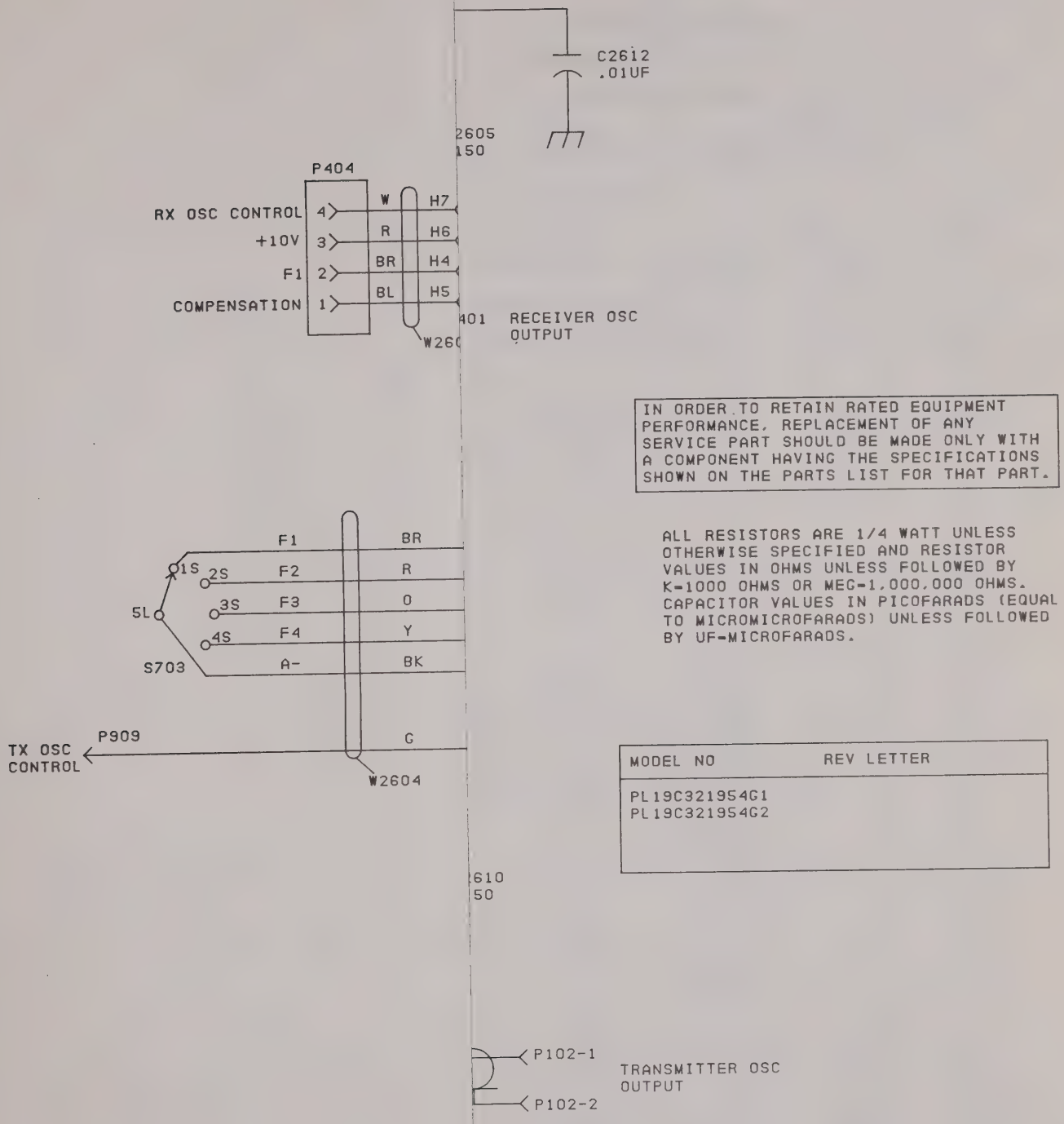
NOTES:
1. REMOVE DA FROM H1 TO H2 FOR CHANNEL GUARD. (EXCEPT ENCODE ONLY)
2. FOR SPEAKER MUTE FUNCTION WITH EXTERNAL DECODER, REMOVE DA FROM H3 TO H4.

(19D423734, Rev. 1)

SCHEMATIC DIAGRAM

SYSTEM-AUDIO-SQUELCH BOARD
19C321920G1

Issue 1



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

MODEL NO	REV LETTER
PL19C321954G1 PL19C321954G2	

SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2

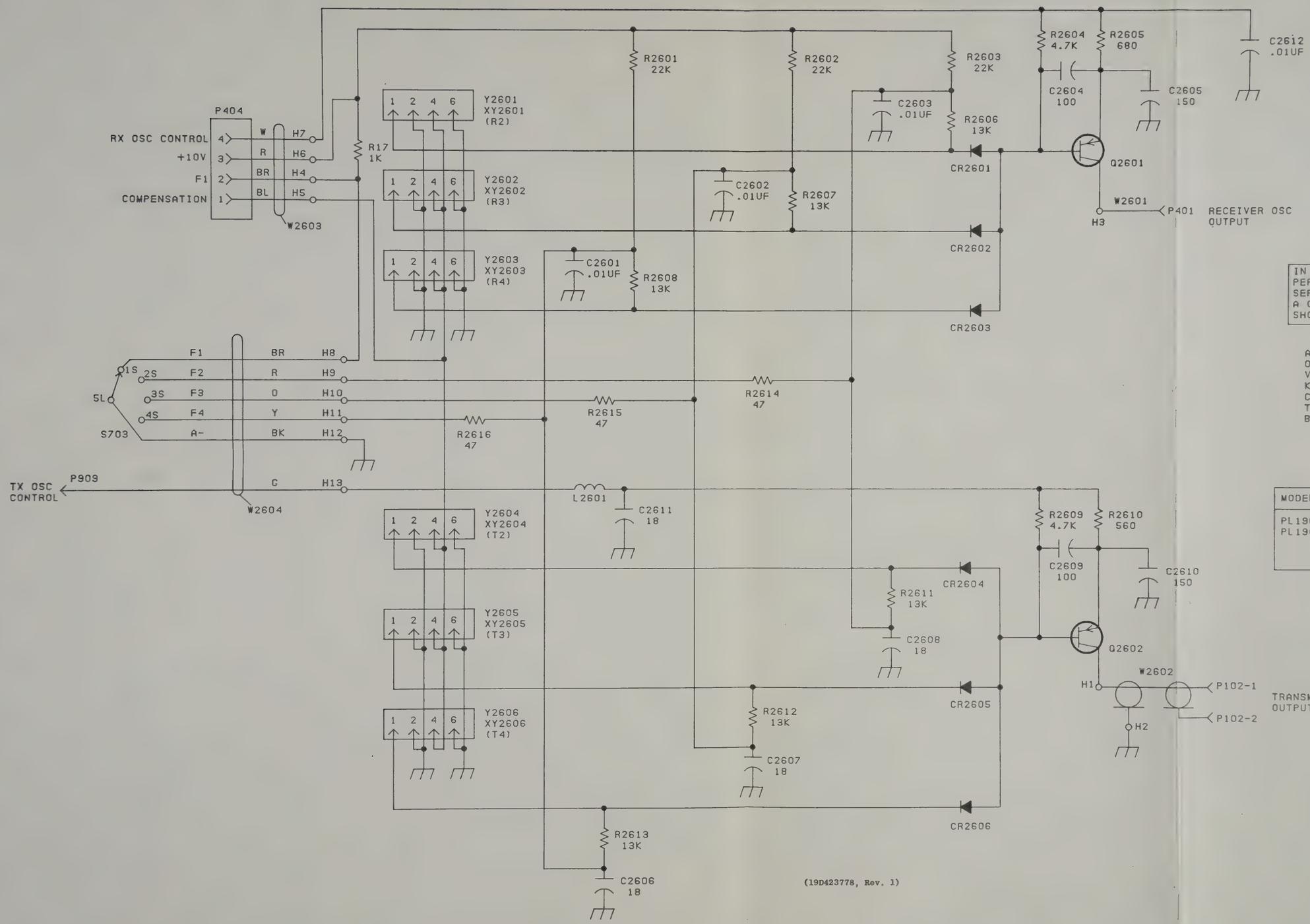
PARTS LIST

LBI-30136

MASTR CUSTOM MVP
SYSTEM - AUDIO - SQUELCH BOARD
19C321920G1

SYMBOL	GE PART NO.	DESCRIPTION
AR901	19A134339P1	Integrated circuit, linear: sim to SGS-ATES TBA810AS.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C901	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C902	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C903	19A116080P106	Polyester: 0.068 µf ±10%, 50 VDCW.
C904	19A134202P13	Tantalum: 0.68 µf ±20%, 35 VDCW.
C905	5496267P230	Tantalum: 0.82 µf ±10%, 35 VDCW; sim to Sprague Type 150D.
C906 and C907	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C908	19A134202P3	Tantalum: 4.7 µf ±20%, 10 VDCW.
C909	19A116080P108	Polyester: 0.15 µf ±10%, 50 VDCW.
C910 and C911	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C912	19A134202P14	Tantalum: 1 µf ±20%, 35 VDCW.
C913	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C914	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C915	19A134319P2	Electrolytic: 330 µf +75% -10%, 25 VDCW; sim to Sprague 502D189.
C916	19A134202P2	Tantalum: 47 µf ±20%, 6 VDCW.
C917	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C918	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C919	5494481P124	Ceramic disc: 1500 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C920 and C921	19A134319P1	Electrolytic: 220 µf +75% -10%, 25 VDCW; sim to Sprague 502D182.
C922	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C923	19A134202P3	Tantalum: 4.7 µf ±20%, 10 VDCW.
C924	19A134202P12	Tantalum: 0.47 µf ±20%, 35 VDCW.
C925	19A134319P1	Electrolytic: 220 µf +75% -10%, 25 VDCW; sim to Sprague 502D182.
C926	19A134319P2	Electrolytic: 330 µf +75% -10%, 25 VDCW; sim to Sprague 502D189.
C927	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C928 thru C933	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C934 and C935	19A116656P27J0	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR901	19A115250P1	Silicon.
CR902	4037822P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - -
J901	19A116659P13	Connector, printed wiring: 4 contacts; sim to Molex 09-64-1041.
J904	19A116659P12	Connector, printed wiring: 6 contacts; sim to Molex 09-64-1061.
J905	19A116659P11	Connector, printed wiring: 7 contacts; sim to Molex 09-64-1071.
J906	19A116659P12	Connector, printed wiring: 6 contacts; sim to Molex 09-64-1061.
J908	19A116659P26	Connector, printed wiring: 3 contacts; sim to Molex 09-64-1031.
J909 thru J913	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q901	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q902 thru Q904	19A115910P1	Silicon, NPN; sim to Type 2N3904.
Q905	19A116375P1	Silicon, PNP.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R901	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R902	3R152P302J	Composition: 3000 ohms ±5%, 1/4 w.
R903	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R904	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R905	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R906	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R907	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R908	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R909	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R910	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R911	3R152P222K	Composition: 2200 ohms ±10%, 1/4 w.
R912	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R913	3R152P910J	Composition: 91 ohms ±5%, 1/4 w.
R914	19B209022P103	Wirewound: .33 ohms ±10%, 2 w; sim to IRC Type BWH.
R916	3R152P471J	Composition: 470 ohms ±5%, 1/4 w.
R917	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R918	3R152P113J	Composition: 11,000 ohms ±5%, 1/4 w.
R919	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R920	3R152P333J	Composition: 33,000 ohms ±5%, 1/4 w.
R921	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R922	3R152P202J	Composition: 2000 ohms ±5%, 1/4 w.
R923	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R924	3R152P150K	Composition: 15 ohms ±10%, 1/4 w.
R925	3R152P820K	Composition: 82 ohms ±10%, 1/4 w.
R926	7147161P19	Composition: 1.0 ohms ±5%, 1/2 w.
R927	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R928	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R929	3R152P621J	Composition: 620 ohms ±5%, 1/4 w.
R930	3R152P682K	Composition: 6800 ohms ±10%, 1/4 w.
R931	3R152P100J	Composition: 10 ohms ±5%, 1/4 w.
		- - - - - - - - - - THERMISTORS - - - - - - - -
RT901	5490828P38	Thermistor: 1400 ohms ±5%, color code green and white; sim to Carborundum Type 723H-2.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U901	19D416560G1	Hybrid Squelch.
U902	19D416564G3	Regulator, 10 volt.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



(19D423778, Rev. 1)

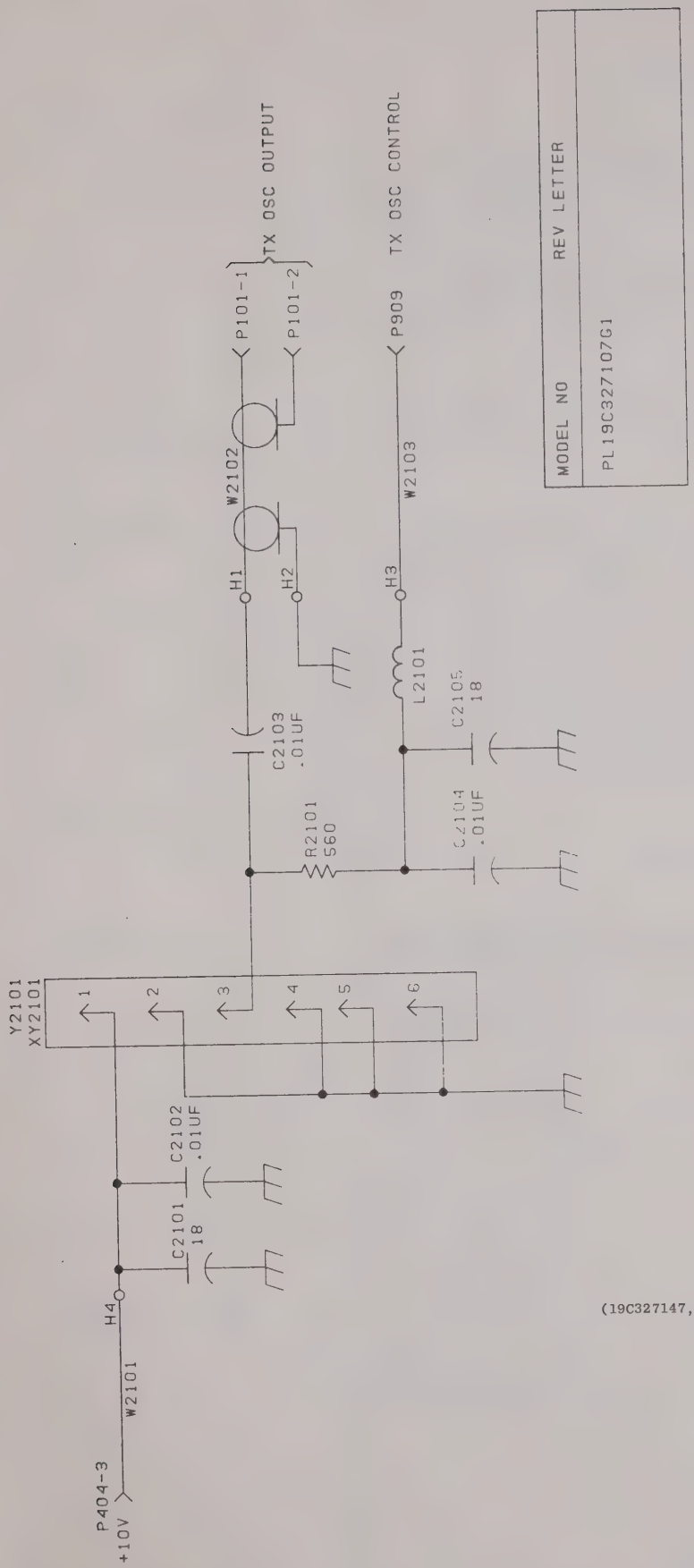
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS.

MODEL NO	REV LETTER
PL19C321954G1 PL19C321954G2	

SCHEMATIC DIAGRAM

MULTI-FREQUENCY KIT
19C321954G1 & G2



MODEL NO	REV LETTER
PL19C327107G1	

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS.

(19C327147, Rev. 1)

SCHEMATIC DIAGRAM

2 PPM OSCILLATOR BOARD 19C327107G1

PARTS LIST

LBI-30180

MULTI-FREQUENCY BOARD
19C321954G1 HIGH BAND/LOW BAND
19C321954G2 UHF BAND

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2601 thru C2603	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C2604	5496218P763	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2605	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2606 thru C2608	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2609	5496218P763	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C2610	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2611	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2612	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2601 thru CR2606	19A134273P1	Silicon: sim to Type 1N458A.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2601	19A129773G3	Coil.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P102	19A127042P2	Terminal, solderless: sim to Malco 12093-10. (Part of W2603A, W2602B).
P401	19A127042P2	Terminal, solderless: sim to Malco 12093-10. (Part of W2601).
P404	19A116659P84	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3103. (Part of W2603).
P909		(Part of W2604).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2601 and Q2602	19A115852P1	Silicon, PNP; sim to Type 2N3906.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2601 thru R2603	3R152P223J	Composition: 22,000 ohms ±5%, 1/4 w.
R2604	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R2605	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
R2606 thru R2608	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R2609	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R2610	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R2611 thru R2613	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R2614 thru R2616	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R2617	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S703		(Part of W2604).

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W2601	19A129947G2	Single conductor: approx 3 inches long. (Includes P401).
W2602A	19A130744G5	Two conductor: approx 7 inches long. (Includes P102).
W2602B	19A130744G6	2 conductor: approx 2.5 inches long. (Includes P102).
W2603	19B226965G3	2 conductor: approx 5.5 inches long. (Includes P404).
W2604		CABLE ASSEMBLY 19B227315G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S703	5495454P45	Rotary: 1 section, 1 pole, 2 to 4 positions (with adj. stop), non-shorting contacts, 2 amps at 25 VDC or 1 amp at 110 VAC; sim to Oak Type "A".
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2601 thru XY2606	19A130958G1	Connector, printed wiring: 6 contacts; sim to Molex 09-65-1061.
		- - - - - - - - - CRYSTAL MODULES - - - - - - - - -
		NOTE: When reordering give GE Part Number and specify exact transmitter or receiver frequency needed.
Y2601 thru Y2606	19B226962G1	Tx. 5 PPM (30-36 MHz).
	19B226962G2	Tx. 5 PPM (36-42 MHz).
	19B226962G3	Tx. 5 PPM (42-50 MHz).
	19B226962G4	Tx. 5 PPM (138-155 MHz).
	19B226962G5	Tx. 5 PPM (150.8-174 MHz).
	19B226962G6	Tx. 5 PPM (406-420 MHz).
	19B226962G7	Tx. 5 PPM (450-470 MHz).
	19B226962G8	Tx. 5 PPM (470-494 MHz).
	19B226962G9	Tx. 5 PPM (494-512 MHz).
	19B226962G10	Rx. 5 PPM (30-36 MHz).
	19B226962G11	Rx. 5 PPM (36-42 MHz).
	19B226962G12	Rx. 5 PPM (42-50 MHz).
	19B226962G13	Rx. 5 PPM (138-155 MHz).
	19B226962G14	Rx. 5 PPM (150.8-174 MHz).
	19B226962G15	Rx. 5 PPM (406-420 MHz).
	19B226962G16	Rx. 5 PPM (450-470 MHz).
	19B226962G17	Rx. 5 PPM (470-494 MHz).
	19B226962G18	Rx. 5 PPM (494-512 MHz).
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	N80P13016C6	Screw, panhead: No. 6-32 x 1.
	7165075P4	Hex nut, brass: thd. size No. 3/8-32.
	N404P13C6	Lockwasher, internal tooth: No. 6.
	19B227473G1	Support.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

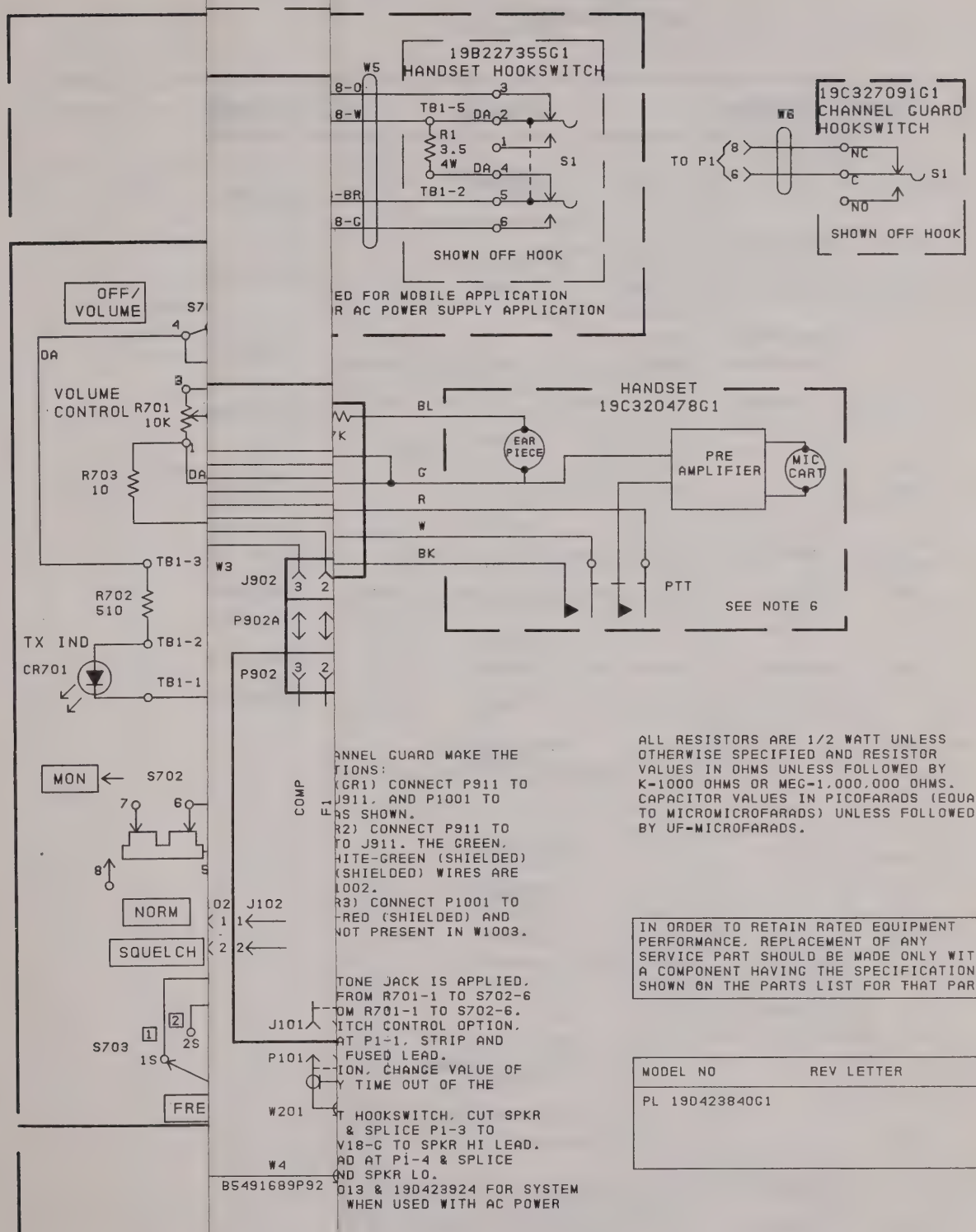
PARTS LIST

LBI-30179

2 PPM OSCILLATOR BOARD
19C327107G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C2101	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2102 thru C2104	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C205	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2101	19A129773G3	Coil.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4036634P1	Contact, electrical; sim to AMP 42428-2.
P404-3	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2101	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2101	19A129947G2	Single conductor: approx 3 inches long.
W2102	19A130744G4	2 conductor: approx 4 inches long.
W2103	19A129947G5	Single conductor.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2101	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 6).
		- - - - - - - - - - Tx ICOMS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency For STANDARD LOW SIDE INJECTION FREQUENCY.
		ICOM FREQ. = Operating Freq. / 36
Y2101	19A129393G15	Externally compensated: ±2 PPM, 406-512 MHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



INTERCONNECTION DIAGRAM

MASTR CUSTOM MVP

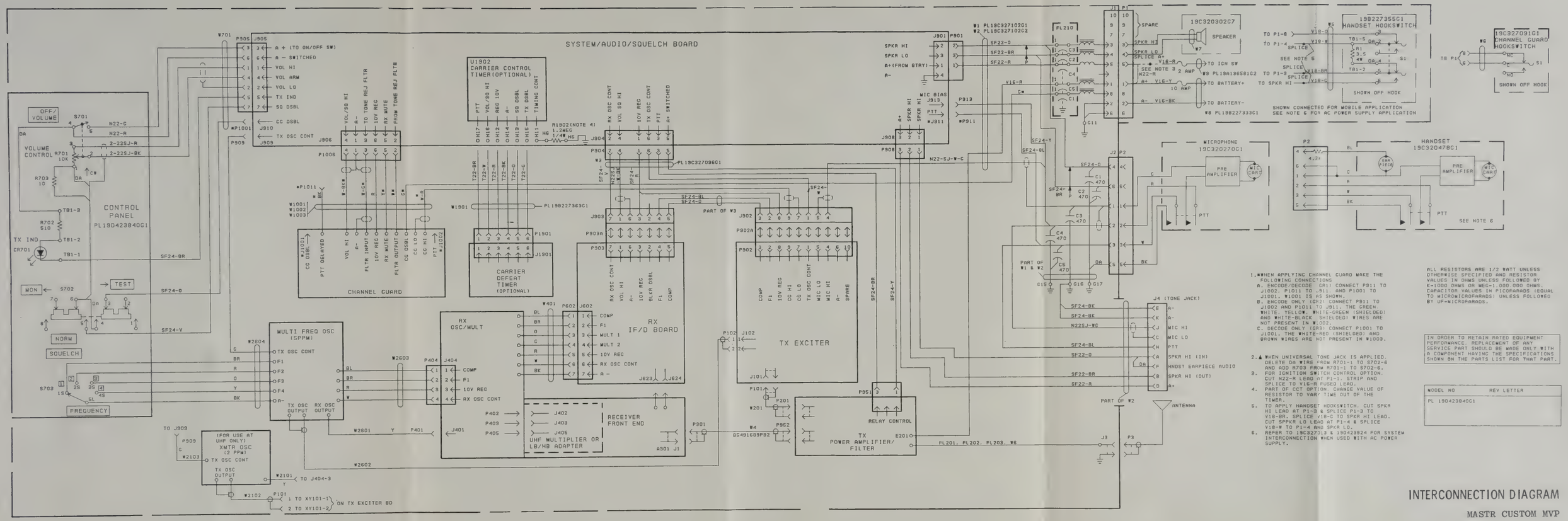
PARTS LIST

LBI-30179

2 PPM OSCILLATOR BOARD
19C327107G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C2101	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2102 thru C2104	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C205	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2101	19A129773G3	Coil.
		- - - - - - - - - - - - PLUGS - - - - - - - - - -
P101	4036634P1	Contact, electrical; sim to AMP 42428-2.
P404-3	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P909	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R2101	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W2101	19A129947G2	Single conductor: approx 3 inches long.
W2102	19A130744G4	2 conductor: approx 4 inches long.
W2103	19A129947G5	Single conductor.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY2101	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 6).
		- - - - - - - - - - Tx ICOMS - - - - - - - - -
		NOTE: When reordering specify ICOM Frequency For STANDARD LOW SIDE INJECTION FREQUENCY.
		ICOM FREQ. = Operating Freq. / 36
Y2101	19A129393G15	Externally compensated: ±2 PPM, 406-512 MHz.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4.
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.



1. ▲WHEN APPLYING CHANNEL GUARD MAKE THE FOLLOWING CONNECTIONS
   A. ENCODE/DECODE (CR1) CONNECT P811 TO J1002, P1011 TO J811, AND P1001 TO J1001. ▼1001 IS AS SHOWN.
   B. ENCODE ONLY (CR2) CONNECT P811 TO J1002 AND P1011 TO J811. THE GREEN, WHITE, YELLOW, WHITE-GREEN (SHIELDED) AND WHITE-BLACK (SHIELDED) WIRES ARE NOT PRESENT IN ▼1002.
   C. DECODE ONLY (CR3) CONNECT P1001 TO J1001. THE WHITE-RED (SHIELDED) AND BROWN WIRES ARE NOT PRESENT IN ▼1003.
2. ▲WHEN UNIVERSAL TONE JACK IS APPLIED, DELETE DA WIRE FROM R701-1 TO S702-6 AND ADD R703 FROM R701-1 TO S702-6.
3. FOR IGNITION SWITCH CONTROL OPTION, CUT W22-R LEAD AT P1-1, STRIP AND SPLICE TO V16-R FUSED LEAD.
4. PART OF CCT OPTION. CHANGE VALUE OF RESISTOR TO VARY TIME OUT OF THE TIMER.
5. TO APPLY HANDSET HOOKSWITCH, CUT SPKR HI LEAD AT P1-3 & SPLICE P1-3 TO V18-BR. SPLICE V18-C TO SPKR HI LEAD. CUT SPKR LO LEAD AT P1-4 & SPLICE V18-W TO P1-4 AND SPKR LO.
6. REFER TO 19C327213 & 19D423924 FOR SYSTEM INTERCONNECTION WHEN USED WITH AC POWER SUPPLY.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

MODEL NO	REV LETTER
PL 19D423840G1	

(19B622220, Rev. 2)

INTERCONNECTION DIAGRAM

MASTR CUSTOM MVP

PARTS LIST

LBI-30181

MASTR CUSTOM MTP
AND
ASSOCIATED ASSEMBLIES

SYMBOL	GE PART NO.	DESCRIPTION
		CONTROL PANEL 19D423840G1
		- - - - - - - - DIODES AND RECTIFIERS - - - - - - - -
CR701	19B219800G4	Diode, light emitting.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P905		Connector. Includes:
	19A116659P82	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108. (Quantity 7).
P1001	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701		(Part of S701).
R702	3B77P511J	Composition: 510 ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701	5496870P35	Variable, carbon film: 10,000 ohms ±20%; sim to Mallory LC(10E) FAC. (Includes R702).
S702	19A136564G1	Switch, slide: 2 poles, 3 positions, spring return: sim to Switchcraft 11D-1154.
		- - - - - - - - TERMINAL BOARD - - - - - - - -
TB1	7487424P18	Miniature, phen: 3 terminals.
		- - - - - - - - - - CABLES - - - - - - - - - -
W701		HARNESS ASSEMBLY 19D423840G2 (Includes R701, S701, S702, P905, P1001)
		ASSOCIATED ASSEMBLIES
		POWER CABLE 19B227333G1
		- - - - - - - - - - PLUGS - - - - - - - - - -
P1	19A115884P11	Plug: sim to AMP 1-480285-0.
	19A136581G1	Fused lead.
	19A136580G1	Lead.
		TRANSMIT RECEIVE HARNESS 19C327096G1
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J902		Connector. Includes:
	19A116659P81	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
J903	19A136600G1	Connector, printed wiring: 8 contacts; sim to Molex 09-52-3082.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P904		Connector. Includes:
	19A116659P80	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
P951		Connector. Includes:
	19A116659P14	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
		SYSTEM HARNESS 19C327102G1 STANDARD 19C327102G2 WITH TONE
		- - - - - - - - - - CAPACITORS - - - - - - - -
C1 thru C5	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J2	19B219627G1	Connector: 6 contacts.
J4	7489183P7	Receptacle: 9 contacts rated at 7.5 amps max; sim to Winchester M93-LR-H19C.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P901		Connector. Includes:
	19A116659P84	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
P908		Connector. Includes:
	19A116659P16	Shell.
	19A116781P6	Contact, electrical: wire range No. 22-26 AWG; sim to Molex 08-50-0108.
P911	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
P913	19A127042P2	Terminal, solderless: sim to Malco 12093-10.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R703	3B77P106J	Composition: 10 ohms ±5%, 1/2 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A116781P5	Contact, electrical: wire range No. 16-20 AWG; sim to Molex 08-50-0106. (Connects to P901-2, P901-3 on System Harness).
	4036835P6	Terminal, solder: sim to Shakeproof 2102-06-00. (Used with J2 on System Harness).
	19B227467G1	Housing.
	NP280149	Faceplate.
	19A136561P1	Dummy support.
	19B209591P1	Knob. (Used with S701 and dummy support).
	N402P13C13	Plain washer. (Used with dummy support).
	4035007P4	Retainer ring. (Used with dummy support).
	7165075P4	Hex nut, brass: thd. size No. 3/8-32. (Secures S701).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures S702).
	19A134330P1	Knob, pushon. (Used with S702).
	19A116677P2	Bushing: sim to Opcon, Inc. OC-1. (Used with CR701).

PARTS LIST

LBI-30175

CHANNEL GUARD HOOKSWITCH
19C327091G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19B209099P1	Sensitive: 10.1 amps at 125 VAC, or .5 amp at 12 VDC; sim to Cherry Electrical Products E62-10A, SPDT.
		- - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B204721P1	Actuator spring.
	4033802P1	Power cable, 2 conductor, approx 4 feet long.
	19A115884P8	Connector, plug: sim to AMP 60527-1. (Located on cable end).
	N183P1408C13	Tap screw: No. 8-18 x 1/2.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

PARTS LIST

LBI-30174

HANDSET HOOKSWITCH
19B227335G1

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5493035P10	Wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HH.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	19A136584G1	Handset, holder: 1 amp at 125 v; sim to Telephone Components Inc. Brook-Tel No. 1010S.
		- - - - - - - - - - TERMINAL BOARD - - - - - - - -
TB1	7775500P55	Phen: 2 insulated, 1 grounded terminal.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1	19B227334G1	4 conductor, approx 30 inches long.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4029851P5	Clip loop. (Used with W1).
	19B219852P1	Mounting plate.
	19A129586G1	Bumper.
	19B201074P205	Tap screw, Phillips POZIDRIV®: No. 4-40 x 5/16. (Secures clip loop).
	N193P1410P2	Tap screw: No. 8-18 x 5/8. (Secures hookswitch).
	N190P1312C6	Cut screw: No. 8. (Secures bottom of housing to back plate).
	N84P13012C6	Machine screw, flat head: No. 6-32 x 3/4. (Secures upper housing to back plate.
	N80P15016C6	Machine screw: No. 8-32 x 1. (Secures rubber bumpers to housing).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

LBI-30194

SPEAKER
19C320302G7

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - LOUDSPEAKERS - - - - - - - - - -
LS2	19A116910P1	Permanent magnet: 5 inch, 3.2 ohms ±15% imp, 5 w max operating; sim to Pioneer 002009.
		- - - - - - - - - - - CABLES - - - - - - - - - - -
W5	19A136574G1	Power: 2 conductor.
		- - - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219692G1	Grille.
	19D416396P1	Housing.
	19C320016P1	Mounting bracket. (Located between housing and retaining bracket).
	19A116986P108	Tap screw, with lockwasher: No. 7-19 x 1/2. (Secures speaker to housing).
	19A116986P112	Tap screw, with lockwasher: No. 7-19 x 3/4. (Secures grille to housing).
	19A116985P1	Tap screw, with lockwasher: No. 13-16 x 3/4.
	N130P1610C6	Screw, thread forming: No. 10-16 x 5/8.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES.

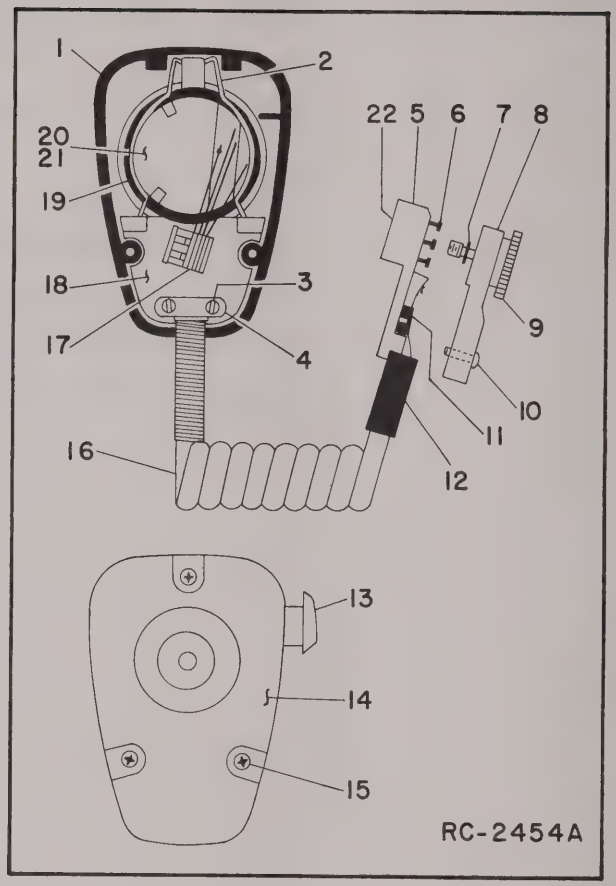
PARTS LIST

LBI-4481A

TRANSISTORIZED DYNAMIC MICROPHONE
19C320270G1
(SEE RC-2454)

SYMBOL	GE PART NO.	DESCRIPTION
1		Front Case Assembly. RP127. (includes items 14, 15).
2		Retaining spring. (Part of item 18).
3		Tap screw, phillips. (Part of item 16).
4		Retaining bar. (Part of item 16).
5	19D416766P1	Connector base.
6	19A129435P1	Contact.
7	7109043P1	Retaining ring.
8	19D416767P1	Connector cover.
9	19B219723G1	Screw.
10	N136AP905C	Tap screw, phillips: No. 4 x 5/16.
11	19A116937P1	Cable clip.
12	19B219749P1	Strain relief.
13		Switch button kit. RP126.
14		Rear Case Assembly. (Part of item 1).
15		Tap screw, phillips. (Part of item 1).
16	19C321016G1	Cable assembly: Includes items 3-12 and cable RP129.
17		Switch Assembly. RP128.
18		Grille Assembly. RP130. (includes items 2, 19, 21).
19		"O" Ring. (Part of item 18).
20		Transistorized Cartridge. RP117.
21		Washer. (Located under cartridge- part of item 18).
22	19C321016G3	Connector assembly: Includes items 5-12.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



SERVICE SHEET

DYNAMIC MICROPHONE
19C320270G1

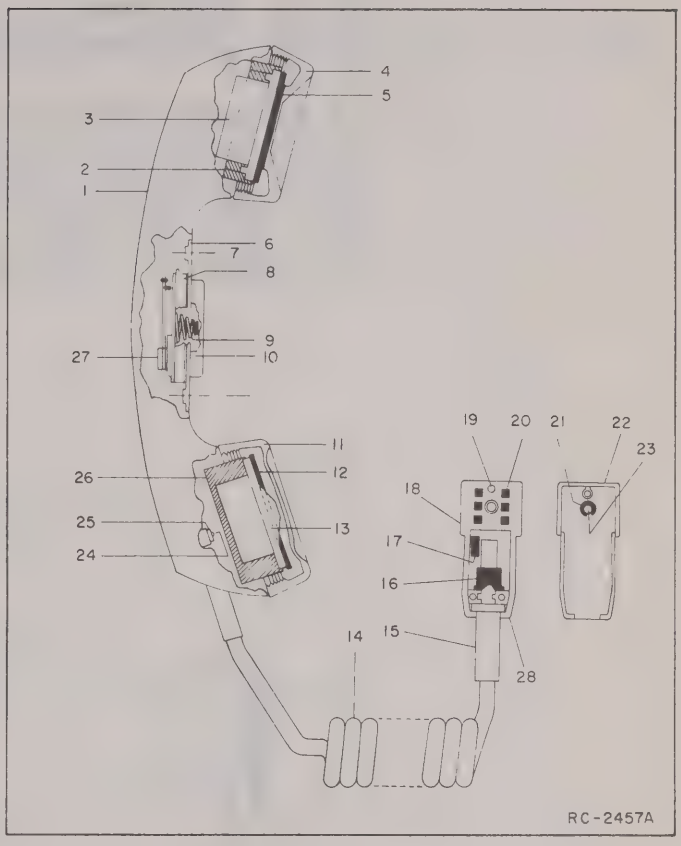
PARTS LIST

LBI-4482A

TRANSISTORIZED DYNAMIC HANDSET
19C320478G1

SYMBOL	GE PART NO.	DESCRIPTION
1		Case Assembly. Includes items 1, 2, 4, 5, 11, 12, 26. Shure Brothers RP142.
2		Adapter. Part of item 1.
3		Receiver Cartridge. Shure Brothers RP140.
4		Receiver Cap. Part of item 1.
5		Washer. Part of item 1.
6		Escutcheon. Part of item 27.
7		Flat head screw, socket cap: No. 4-40 x 1/4. Part of item 27.
8		Actuator. Part of item 27.
9		Spring. Part of item 27.
10		Plunger bar. Part of item 27.
11		Transmitter cap. Part of item 1.
12		Washer. Part of item 1.
13		Transmitter cartridge. Shure Brothers RP139.
14	19C321016G2	Cable assembly: Includes items 14-23 and cable RP141.
15	19B219749P1	Flex relief.
16	19A116937P1	Cable clamp: sim to Malco 21012-3.
17	3R77P472K	Resistor, (R1) Composition, 4700 ohms ±10%, 1/2 w.
18	19D416766P1	Connector case.
19	N136AP905C	Screw.
20	19A129435P1	Pin contact.
21	7109043P1	Retaining ring. 3/16 inch, sim to National Lockwasher WA 510.
22	19D416767P1	Connector Cover.
23	19B219723G1	Screw. (Secures cover, item 22 to case, item 18).
24		Screw. Part of item 14.
25		Cable clamp. Part of item 14.
26		Shield. Part of item 1.
27		Switch Assembly. Includes items 6-10. Shure Brothers RP143.
28	19C321016G3	Connector assembly: Includes items 15, 16, 18-23. Does not include resistor, item 17.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Incorporated into initial shipment.

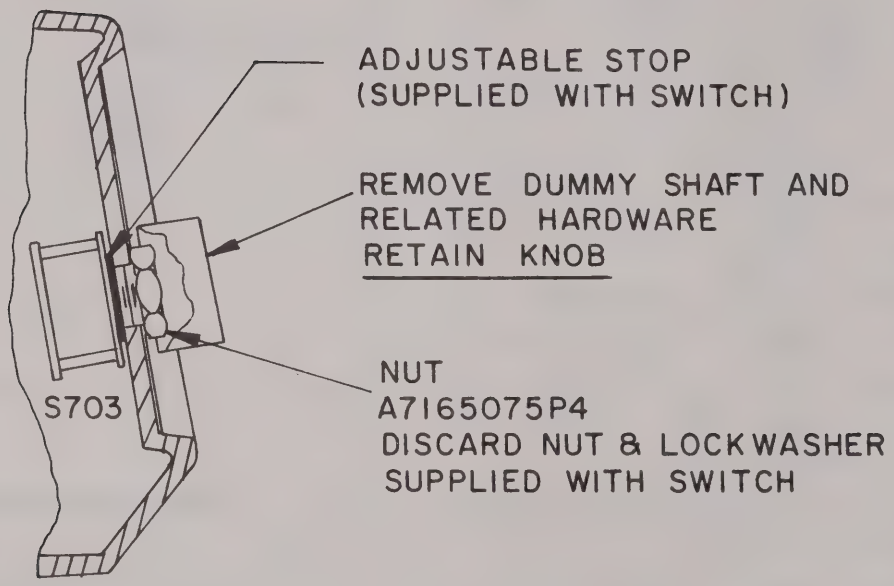
MULTI-FREQUENCY INSTALLATION

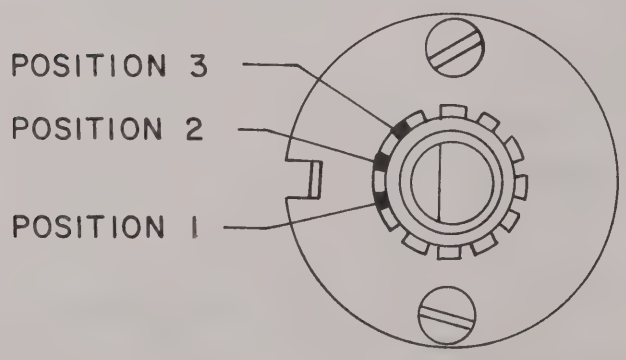
1. WHEN INSTALLING MULTI-FREQ., THE FOLLOWING MODIFICATIONS MUST BE PERFORMED:

   CUT THE BLUE WIRE OUT OF HARNESS (W401) FROM OSC/MULT TO I.F. DETECTOR BD.

   CUT THE ORANGE WIRE OUT OF HARNESS (W3) FROM J902-3 TO J903-5.

2. THE FREQUENCY SELECT SWITCH (S703) STOP IS TO BE SET TO CONFORM WITH THE DESIRED NUMBER OF FREQ.
   ROTATE SWITCH FULLY COUNTERCLOCKWISE.
   FOR 2 FREQ. SET STOP IN POSITION 1.
   FOR 3 FREQ. SET STOP IN POSITION 2.
   FOR 4 FREQ. SET STOP IN POSITION 3.





SWITCH (S703) VIEWED FROM SHAFT END (ENLARGED)

RC-2964

INSTALLATION INSTRUCTION

MULTI-FREQUENCY KIT 19C321954

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model Number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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MOBILE RADIO

MAINTENANCE MANUAL
IF-DETECTOR BOARD 19C321662G1-G3

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CIRCUIT ANALYSIS ..... page 1

OUTLINE DIAGRAM ..... page 4

SCHEMATIC DIAGRAM ..... page 5

PARTS LIST ..... page 6

DESCRIPTION

The IF-Detector board (IF-DET) provides approximately 120 dB gain at the IF frequency, detects the audio frequencies and provides the volume squelch Hi output to the System-Audio & Squelch board (SAS). The F1 keying lead, and RX OSC control from the SAS board, compensation voltage from the exciter and the regulated +10 Volt circuits are completed through P903 and J602 on the IF-DET board.

IF-DET board 19C321662G2 contains a 4-pole and a 2-pole crystal filter and operates with an IF frequency of 9.4 MHz. It is used in radios with an operating frequency of 30-36 MHz and 42-50 MHz.

IF-DET board 19C321662G1 also contains a 4-pole and a 2-pole crystal filter it operates with an IF frequency of 11.2 MHz and is used in radios with an operating frequency of 36-42 MHz.

IF-DET board 19C321662G3 contains two 2-pole crystal filters and operates with an IF frequency of 11.2 MHz. It is used in radios with an operating frequency of:

- 138-174 MHz
- 406-420 MHz
- 450-512 MHz

CIRCUIT ANALYSIS

CRYSTAL FILTERS, IF AMP & LIMITER-DETECTOR

The IF input from the MIF or IF Filter board is applied to a four-pole monolithic crystal filter (FL601 and FL602) in radios with an operating frequency of 30-50 MHz and a two-pole monolithic crystal filter (FL601) in radios with an operating frequency of 138-174 MHz, 406-420 MHz or 450-512 MHz. The crystal filter provides additional selectivity and is followed by an impedance matching network Z601 and IF amplifier U601. The IC amplifier provides approximately 60 dB gain.

Final IF selectivity is provided by two-pole crystal filter FL603. Impedance matching network Z602 matches the output impedance of IF amplifier IC U601 to the input of two-pole crystal filter FL603. The IF amplifier output is metered at J601-1 through a metering network consisting of C612, C613, CR601 and CR602. Impedance matching network Z603 matches the output impedance of FL603 to the input of Limiter-Detector IC U602.

In addition to providing 60 dB of gain at the IF frequency, Limiter-Detector IC U602, C620, C621 and L603 comprise a quadrature phase detector to recover the audio from the IF frequency. The quadrature phase detector utilizes a 90 degree phase shift in the IF frequency to detect the audio signal. It compares the phase of the IF input at U602-4 with the same IF input frequency shifted 90 degrees at U602-2. The resultant signal varies phase linearly as the carrier signal deviates about the center frequency.

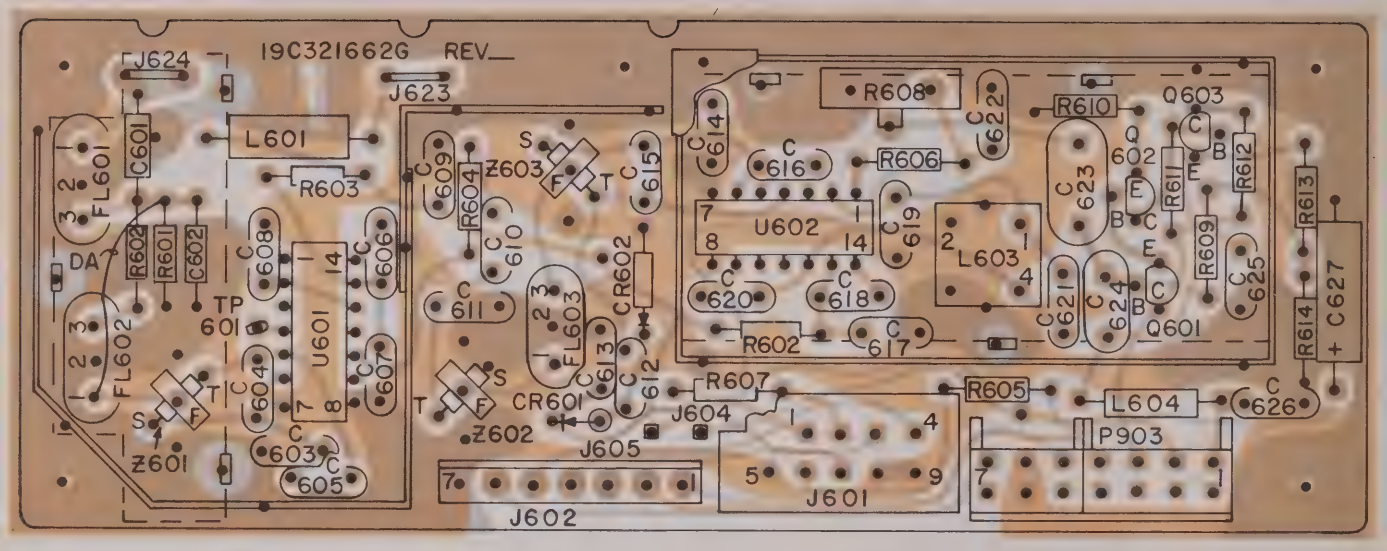
The detector output is adjusted for maximum audio output by L603 and is metered at J601-2 through R607.

AUDIO PREAMPLIFIER

The audio preamplifier consists of transistors Q601, Q602, and Q603. It provides approximately 26 dB of gain.

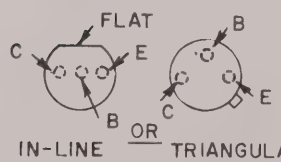
The output of the Limiter-Detector is coupled to the audio preamplifier through audio level adjust control R608. R608 sets the audio input level to the preamplifier circuit.

The output of the audio preamplifier is coupled through a low pass filter (L604 and C626) to volume and squelch control circuit on the SAS board. The filter removes any IF signal remaining in the audio output of the preamplifier.



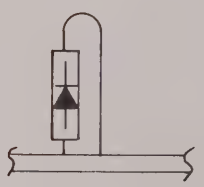
(19C321673, Sh. 2, Rev. 1)
(19C321673, Sh. 3, Rev. 1)

LEAD IDENTIFICATION
FOR Q601, Q602, & Q603



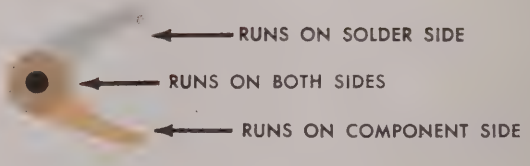
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION. TAB INDICATES EMITTER LEAD.



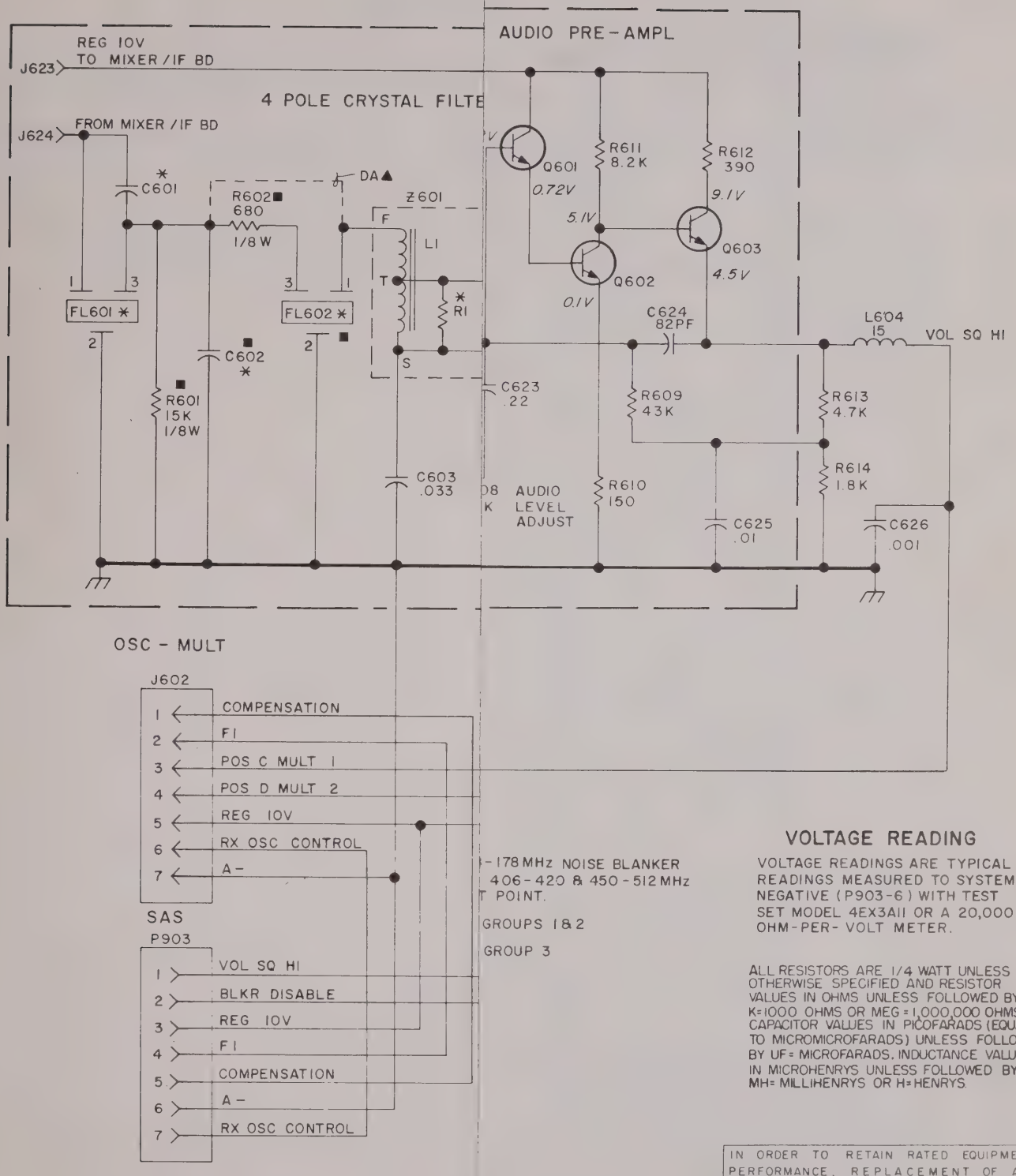
POLARITY FOR CR601

(19C327110, Rev. 0)



OUTLINE DIAGRAM

IF DETECTOR BOARD 19C321662G1-G3



VOLTAGE READING

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-6) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

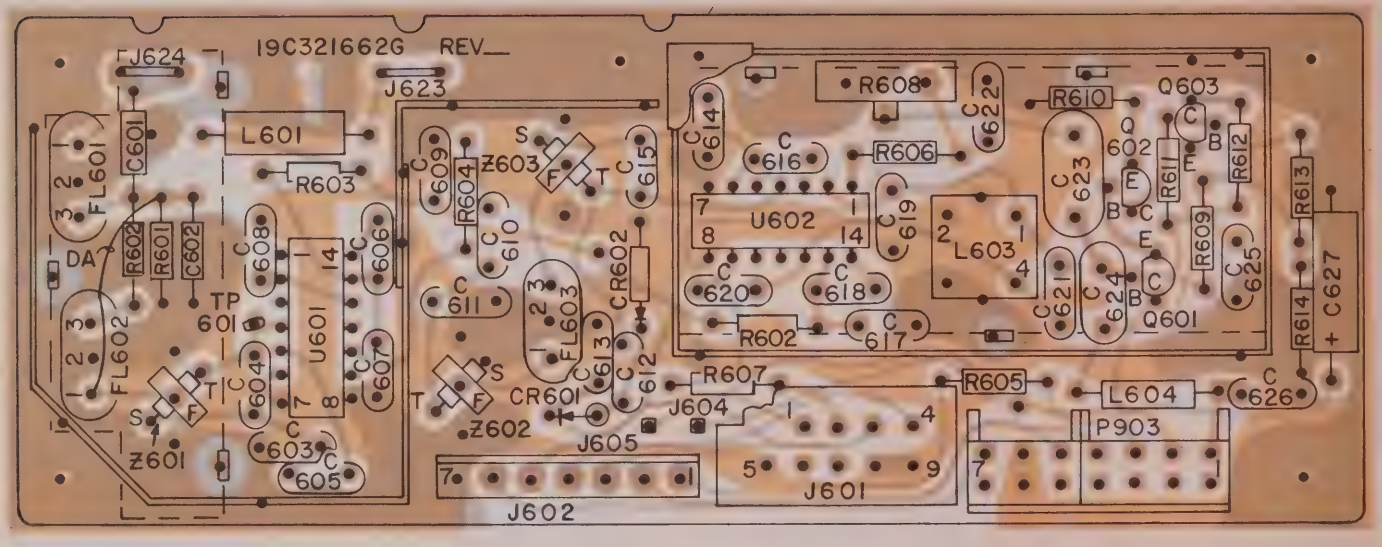
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART

SCHEMATIC DIAGRAM

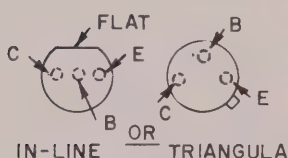
IF DETECTOR BOARD 19C321662G1-G3

Issue 1



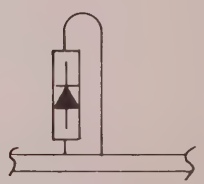
(19C321673, Sh. 2, Rev. 1)
(19C321673, Sh. 3, Rev. 1)

LEAD IDENTIFICATION
FOR Q601, Q602, & Q603



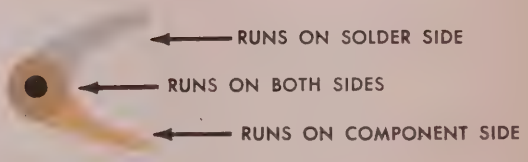
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION. TAB INDICATES EMITTER LEAD.



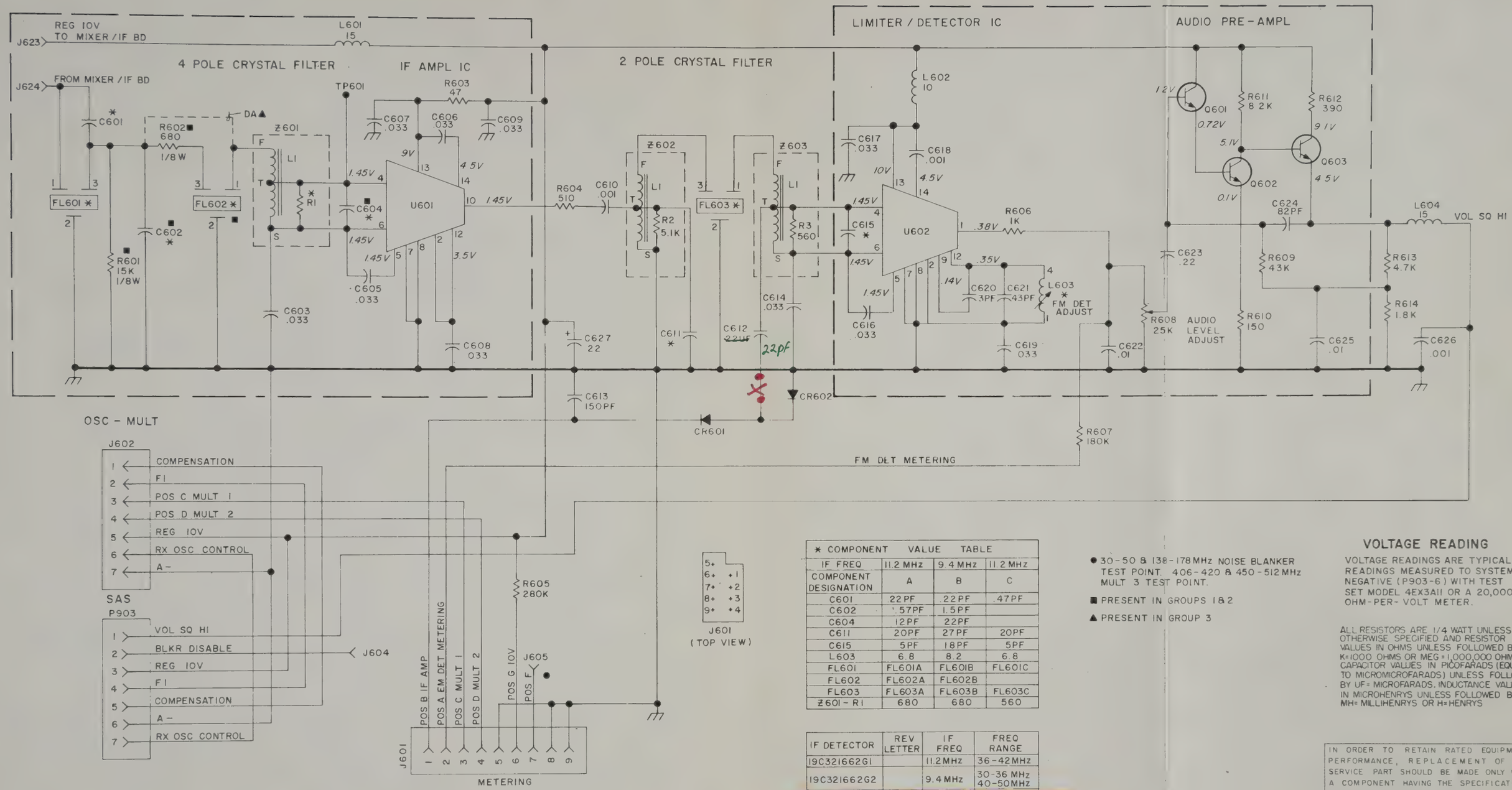
POLARITY FOR CR601

(19C327110, Rev. 0)



OUTLINE DIAGRAM

IF DETECTOR BOARD 19C321662G1-G3



(19D423320, Rev. 2)

* COMPONENT VALUE TABLE			
IF FREQ	11.2 MHz	9.4 MHz	11.2 MHz
COMPONENT DESIGNATION	A	B	C
C601	22PF	22PF	47PF
C602	57PF	1.5PF	
C604	12PF	22PF	
C611	20PF	27PF	20PF
C615	5PF	18PF	5PF
L603	6.8	8.2	6.8
FL601	FL601A	FL601B	FL601C
FL602	FL602A	FL602B	
FL603	FL603A	FL603B	FL603C
Z601 - R1	680	680	560

IF DETECTOR	REV LETTER	IF FREQ	FREQ RANGE
19C321662G1		11.2MHz	36-42MHz
19C32166262		9.4MHz	30-36 MHz 40-50MHz
19C321662G3		11.2MHz	138-174MHz 406-512MHz

● 30-50 & 138-178MHz NOISE BLANKER TEST POINT. 406-420 & 450-512MHz MULT 3 TEST POINT.

■ PRESENT IN GROUPS 1&2

▲ PRESENT IN GROUP 3

VOLTAGE READING

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-6) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

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SCHEMATIC DIAGRAM

IF DETECTOR BOARD 19C321662G1-G3

Issue 1

PARTS LIST

LBI-30081

IF DETECTOR BOARD
19C321662G1 36-42 MHz (IF 11.2 MHz)
19C321662G2 30-36, 42-50 MHz (IF 9.2 MHz)
19C321662G3 138-174, 406-512 MHz (IF 11.2 MHz)

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C601A and C601B	5491601P105	Phenolic: 0.22 pf ±5%, 500 VDCW.
C601C	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C602A	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C602B	5491601P123	Phenolic: 1.5 pf ±5%, 500 VDCW.
C603	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C604A	5496219P642	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -470 PPM.
C604B	5496219P647	Ceramic disc: 22 pf ±10%, 500 VDCW, temp coef -470 PPM.
C605 thru C609	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C610	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C611A	5496219P646	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -470 PPM.
C611B	5496219P649	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -470 PPM.
C611C	5496219P646	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef -470 PPM.
C612	5496219P647	Ceramic disc: 22 pf ±5%, 500 VDCW, temp coef -470 PPM.
C613	5494481P101	Ceramic disc: 150 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C614	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C615A	5496219P636	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
C615B	5496219P645	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -470 PPM.
C615C	5496219P636	Ceramic disc: 5.0 pf ±0.25 pf, 500 VDCW, temp coef -470 PPM.
C616 and C617	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C618	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C619	19A116080P104	Polyester: 0.033 µf ±10%, 50 VDCW.
C620	5496219P334	Ceramic disc: 3.0 pf ±0.25 pf, 500 VDCW, temp coef -150 PPM.
C621	5496219P354	Ceramic disc: 43 pf ±5%, 500 VDCW, temp coef -150 PPM.
C622	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C623	19A116080P109	Polyester: 0.22 µf ±10%, 50 VDCW.
C624	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C625	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C626	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C627	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR601 and CR602	4038056P1	Germanium.
		- - - - - - - - - - FILTERS - - - - - - - - -
FL601A	19B219573G3	Crystal, freq: PAD A: 11,200000 KHz, PAD B: 11,196024 KHz.
FL601B	19B219574G3	Crystal freq: PAD A: 9400.300 KHz, PAD B: 9396.324 KHz.
FL601C	19B219573G1	Crystal freq: PAD A: 11,200000 KHz, PAD B: 11,200000 KHz.
FL602A		(Part of FL601A).
FL602B		(Part of FL601B).
FL603A	19B219573G1	Crystal freq: PAD A: 11,200000 KHz, PAD B: 11,200000 KHz.
FL603B	19B219574G1	Crystal freq: PAD A: 9400.300 KHz, PAD B: 9400.300 KHz.
FL603C	19B219573G1	Crystal freq: PAD A: 11,200000 KHz, PAD B: 11,200000 KHz.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J601	19B219374G1	Connector. Includes:
	19C317957P1	Shell.
	19A116651P1	Contact, electrical; sim to Malco X0-2864.
J602	19A116659P106	Connector, printed wiring: 7 contacts; sim to Molex 09-60-1071.
J604 and J605	19A116779P1	Contact, electrical; sim to Molex 08-54-0404.
J623 and J624	19A116975P1	Contact, electrical.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L601	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
L602	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
L603A	19C311181G13	Coil.
L603B	19C311181G14	Coil.
L603C	19C311181G13	Coil.
L604	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P903		Connector. Includes:
	19A116659P1	Connector, printed wiring: 3 contacts; sim to Molex 09-52-3102.
	19A116659P15	Connector, printed wiring: 4 contacts; sim to Molex 09-52-3042.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q601 thru Q603	19A115910P1	Silicon, NPN; sim to Type 2N3904.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R601	3R151P153J	Composition: 15,000 ohms ±5%, 1/8 w.
R602	3R151P681J	Composition: 680 ohms ±5%, 1/8 w.
R603	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R604	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R605	19C314256P22803	Metal film: 280,000 ohms ±1%, 1/4 w.
R606	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R607	3R152P184J	Composition: 0.18 megohm ±5%, 1/4 w.
R608	19B209358P107	Variable, carbon film: approx 75 to 25,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R609	3R152P433J	Composition: 43,000 ohms ±5%, 1/4 w.
R610	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R611	3R152P822K	Composition: 8200 ohms ±10%, 1/4 w.
R612	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R613	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R614	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
		- - - - - - - - - - TEST POINTS - - - - - - - - - -
TP601	N503P304C6	Cotter pin.
		- - - - - - - INTEGRATED CIRCUITS - - - - - -
U601 and U602	19A116445P1	Integrated circuit, linear: sim to ULN 2111.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z601A and Z601B	19B226649G1	Coil assembly. Includes:
R1	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
Z601C	19B226649G3	Coil assembly. Includes:
R3	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
Z602	19B226649G2	Coil assembly. Includes:
R2	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
Z603	19B226649G3	Coil assembly. Includes:
R3	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19B226648G1	Shield. (Located around FL601, FL602).
	19B219571G1	Shield. (Located under Z601, J624 on opposite side of component board).
	19B219554G1	Can. (Located around U602, Q603)
	19B219555P1	Cover. (Used with 19B219554G1 can).
	19B219727G1	Shield. (Located under 19B219554G1 can).
	19A116428P4	Ground tab; sim to AMP 86031-1 (Strip Form). (Used with shields on bottom of circuit board).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
R610	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R611	3R152P822K	Composition: 8200 ohms ±10%, 1/4 w.
R612	3R152P391J	Composition: 390 ohms ±5%, 1/4 w.
R613	3R152P472J	Composition: 4700 ohms ±5%, 1/4 w.
R614	3R152P182J	Composition: 1800 ohms ±5%, 1/4 w.
		- - - - - - - - - TEST POINTS - - - - - - - - -
TP601	N503P304C6	Cotter pin.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U601 and U602	19A116445P1	Integrated circuit, linear: sim to ULN 2111.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z601A and Z601B	19B226649G1	Coil assembly. Includes:
R1	3R152P681J	Composition: 680 ohms ±5%, 1/4 w.
Z601C	19B226649G3	Coil assembly. Includes:
R3	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
Z602	19B226649G2	Coil assembly. Includes:
R2	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
Z603	19B226649G3	Coil assembly. Includes:
R3	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B226648G1	Shield. (Located around FL601, FL602).
	19B219571G1	Shield. (Located under Z601, J624 on opposite side of component board).
	19B219554G1	Can. (Located around U602, Q603)
	19B219555P1	Cover. (Used with 19B219554G1 can).
	19B219727G1	Shield. (Located under 19B219554G1 can).
	19A116428P4	Ground tab; sim to AMP 86031-1 (Strip Form). (Used with shields on bottom of circuit board).

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number of component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-1105

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

MAINTENANCE MANUAL
138—174 MHz EXCITER BOARD 19D423293G1, G2

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DESCRIPTION

The exciter uses seven transistors, a crystal module and an integrated circuit to provide 250 milliwatt of power to drive the PA assembly. The crystal module determines the (F1) transmitting frequency in single frequency applications.

In multi-frequency transmitters, the crystal modules for frequencies F2-F4 are located on the multi-frequency board.

The crystal frequency ranges from approximately 11.5 to 14.5 megahertz, and is multiplied 12 times.

Audio, supply voltages and control functions are connected from the system audio & squelch board to the exciter board through P902.

Centralized metering jack J103 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the multipliers, amplifier and the regulated 10 Volt supply.

CIRCUIT ANALYSIS

F1 OSCILLATOR CIRCUIT

A Colpitts oscillator comprised of Q102, a plug-in crystal module and associated components provides the fundamental operating frequency for the transmitter. The crystal module in the collector base circuit of Q102 is temperature compensated to maintain frequency stability within ±5 PPM over a temperature range of -30°C to +65°C. Compensation voltage is applied from compensator circuit Q101. The output of the oscillator is taken from the collector of Q102, buffered by Q103 and applied to modulator CR101 and CR102.

With the radio turned on and the PTT switch operated, +10 Volts is present on the Tx OSC lead at P902-1 and the emitter of oscillator Q102. R104 and R105 comprise a voltage divider network to establish the bias voltage for Q102, allowing it to oscillate at the crystal frequency.

SERVICE NOTE

Y1 and C2 are not field replaceable items. C2 is factory selected to compliment the temperature/frequency characteristics of each individual crystal. Should it become necessary to replace either Y1 or C2, the entire crystal module must be replaced.

In single frequency radios, the F1 keying lead is connected directly to A- by a DA jumper connected between H12 and H31 on the system, audio, squelch board (SAS). This assures F1 oscillator operation each time the PTT switch is pressed.

With the radio turned on and the PTT switch operated, +10 Volts is present on the transmitter oscillator lead at P902-1 and the emitter of Q102. R104 and R105 comprise a voltage divider network to establish the base voltage for Q102 allowing it to oscillate at the crystal frequency to allow E1 frequency selection via the frequency selector switch on the control unit.

When frequencies F2 thru F4 are selected the oscillator output frequency from the multi-frequency board is supplied to buffer Q103 through J102-1 on the exciter and cable W2601.

COMPENSATOR CIRCUITS

The crystal modules are temperature compensated at both ends of the temperature range to provide instant frequency compensation. The temperature compensator consists of Q101, VR101, RT101, RT102 and associated components. Zener diode VR101 provides a constant +8.5 V reference voltage for compensator Q101.

The cold end compensation circuit does not operate at temperatures above -10°C (+14°F). When the temperature drops below -10°C, the circuit is activated. As the temperature decreases, the resistance of RT101 decreases and the compensation voltage decreases.

An increase in compensation voltage decreases the capacitance of the varactor in the oscillator, thereby increasing the output frequency of the crystal module.

The hot end compensation circuit does not operate at temperatures below +55°C (131°F). When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the resistance of RT102 decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the crystal module.

Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules. Voltages should be measured using a high impedance meter.

TEMPERATURE RANGE	OUTPUT VOLTAGE MINIMUM	OUTPUT VOLTAGE MAXIMUM
-30°	4.9 Volts	6.0 Volts
-10° to 50°C	3.7 Volts	4.3 Volts
+75°C	3.3 Volts	3.8 Volts

AUDIO IC

The transmitter audio circuitry is contained in audio IC U101. A simplified drawing of the audio IC is shown in Figure 1.

Audio from the microphone at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit. Collector voltage for the transistorized microphone pre-amplifier is supplied from pin 11 through microphone collector lead resistor R18 to pin 12.

The operational amplifier-limiter circuit consists of Q1, Q2, and Q3. Q3 provides limiting at high signal levels. The gain of the operational amplifier circuit is fixed by negative feedback through R19, R20 and the resistance in the network (Pin 9).

The output of Q3 is coupled through a de-emphasis network (R10 and C3) to an active post-limiter filter consisting of C4, C5, C6, R11, R12, R13, R15, R17 and Q4.

Following the post-limiter filter is class A amplifier Q5. The output of Q5 is coupled through MOD ADJUST potentiometer R108 and resistors R109 and R115 to the phase modulators.

SERVICE NOTE: If the DC voltages applied to the audio IC are correct and there is no audio output, replace U101.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulators through P902-9, (CG H1) and resistors R112 and R117. Instructions for setting Channel Guard modulation are located in the Transmitter Alignment Procedures.

BUFFER & PHASE MODULATOR

The oscillator output is coupled through buffer-amplifier Q103 to the modulator. The first phase modulator is varactor (voltage-variable capacitor) CR101 is connected in series with tunable coil L101.

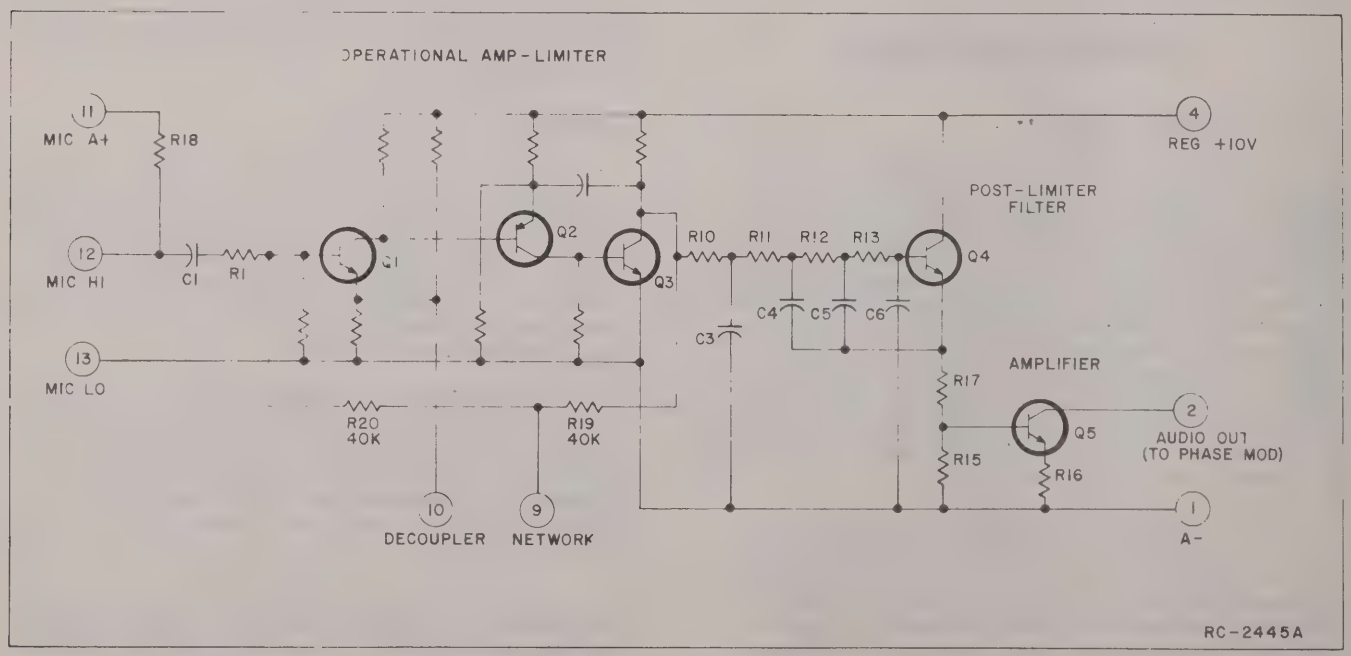


Figure 1 - Simplified Audio IC

CIRCUIT ANALYSIS

This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator circuit through blocking capacitor C114 varies the bias of CR101, resulting in a phase modulated output. A voltage divider network (R109 and R113) provides the proper bias for varactors CR101 and CR102.

The output of the modulator is coupled through blocking capacitor C119 to the base of buffer Q104.

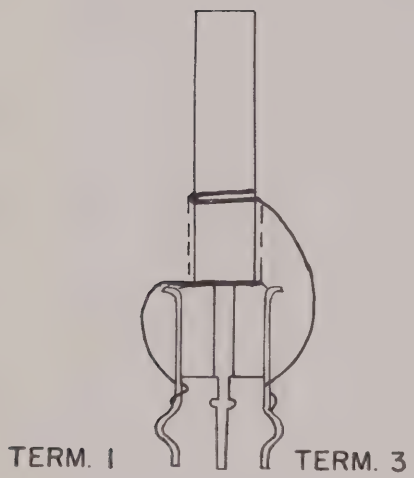
MULTIPLIERS & AMPLIFIER

Buffer Q104 is saturated when no RF signal is present. Applying an RF signal to Q104 provides a sawtooth waveform at its collector to drive class C tripler, Q105. The tripler stage is metered through R122. The output of Q105 is coupled through tuned circuits T101 and T102 to the base of doubler Q106. T101 and T102 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R124.

The output of Q106 is coupled through tuned circuits T103 and T104 to the base of second doubler Q107. T103 and T104 are tuned to one-half the operating frequency. Q107 is metered through R129.

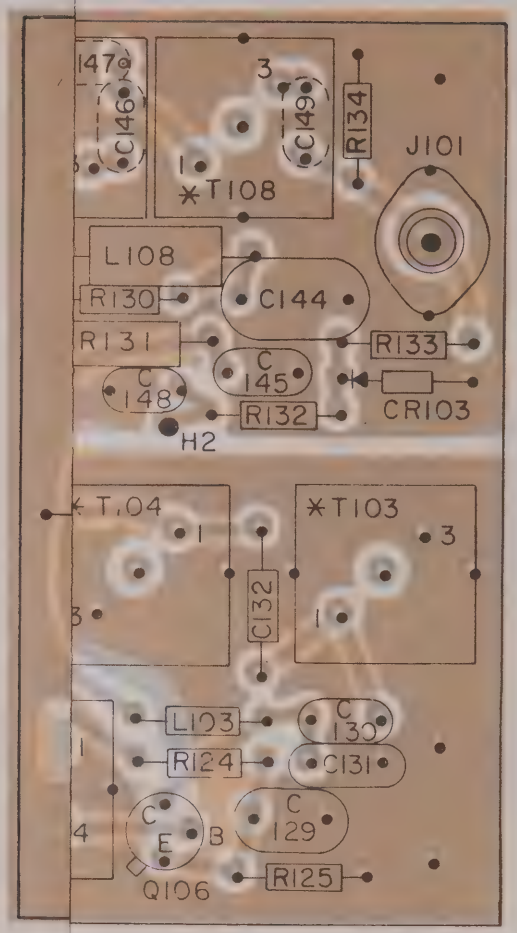
The output of Q107 is coupled through two tuned circuits (T105 and T106) to the base of amplifier Q109. These circuits are tuned to the transmitter operating frequency.

Q108 is a class C amplifier, and is metered through R130. The amplifier collector circuit consists of T107, C146, C147, T108 and C149, and matches the amplifier output to the input of the power amplifier assembly.



DETAIL "C"

L101 & L102 (ENLARGED)



(19D423895, Rev. 0)
(19D423281, Sh. 2, Rev. 1)
(19D423281, Sh. 3, Rev. 1)

LE

SED TAB ON COIL FORM INDICATES
I ON T101 THRU T108

C

IN-L

NOTE: LEAD
CASE
FACT
TAB

RUNS ON SOLDER SIDE

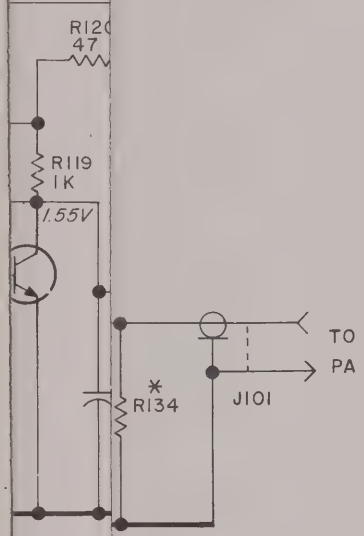
ON BOTH SIDES

RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2

FFER
104



S

ADINGS MADE
MEASURED
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S USED IN
NING

EXCITER BOARD	REV LETTER	FREQ RANGE
19D423293G1		138 - 155 MHz
19D423293G2		150.8-174 MHz

* SEE CHART BELOW FOR VALUE

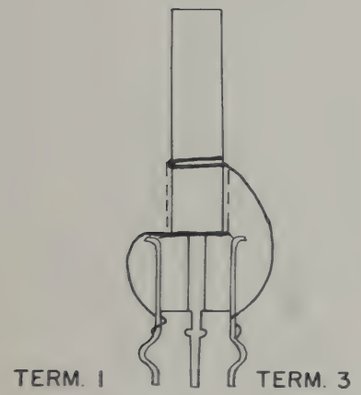
COMPONENT IDENT.	VALUE	
	L 138 - 155	H 150.8-174
C124	30	24
C126	.82	.75
C128	27	24
C130	24	18
C133	24	18
C138	13	8
C139	27	18
C140	.47	.39
C141	8	6
C146	8	6
C147	13	10
C149	8	6
R134	390	NONE

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG = 1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2



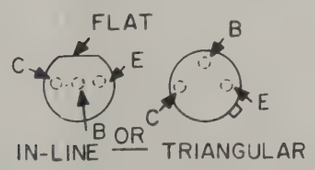
DETAIL "C"

L101 & L102 (ENLARGED)

SEE DETAIL "C"

(19D423895, Rev. 0)
(19D423281, Sh. 2, Rev. 1)
(19D423281, Sh. 3, Rev. 1)

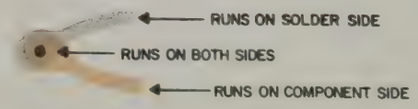
LEAD IDENTIFICATION
FOR Q101 - Q107



TOP VIEW

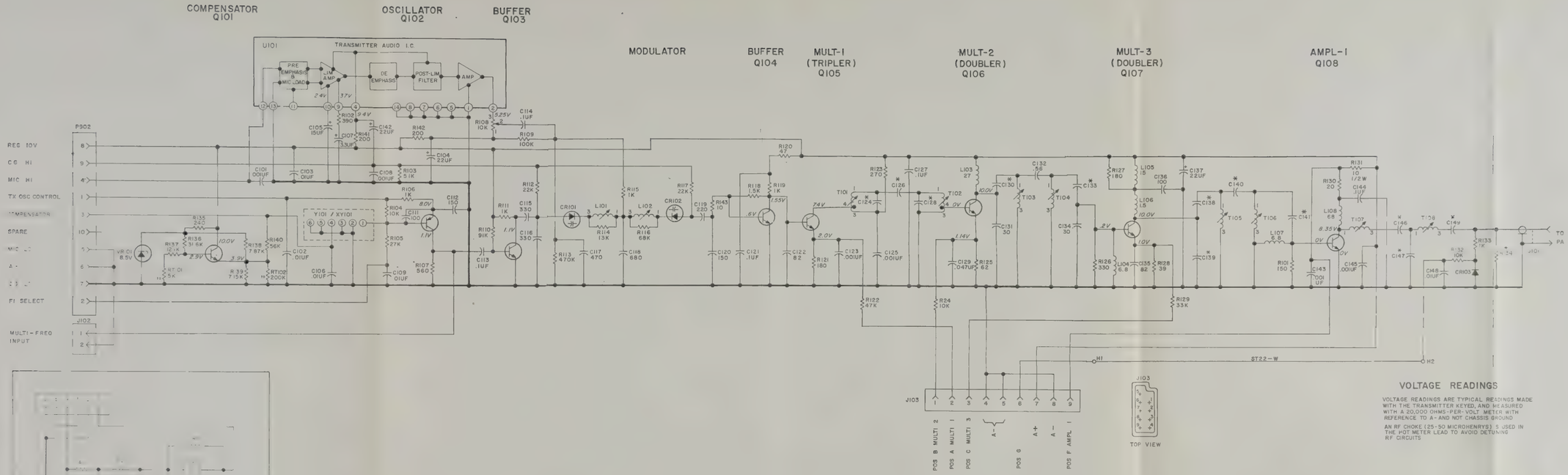
NOTE: LEAD ARRANGEMENT, & NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION TAB INDICATES EMITTER LEAD

* RAISED TAB ON COIL FORM INDICATES PIN 1 ON T101 THRU T108



OUTLINE DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2



TYPICAL CRYSTAL MODULE

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

(19D823171, Rev. 2)

EXCITER BOARD	REV LETTER	FREQ RANGE
19D423293G1		138 - 155 MHz
19D423293G2		150.8-174MHz

* SEE CHART BELOW FOR VALUE

COMPONENT IDENT	VALUE	
	138 - 155	150.8-174
C124	30	24
C126	82	75
C128	47	24
C130	24	18
C133	24	18
C136	3	3
C139	27	18
C140	47	39
C141	8	6
C146	4	3
C147	13	10
C149	8	6
R134	390	NONE

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS, UNLESS FOLLOWED BY K - KILOHMS OR M - MEGOHMS (JUMPER). CAPACITOR VALUES IN MICROFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF - MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS, UNLESS FOLLOWED BY MH MILLIHENRYS OR HH HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT [illegible] REFER TO THE PARTS LIST FOR [illegible]

SCHEMATIC DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2

PARTS LIST

LBI-30064

138-174 MHz EXCITER BOARD
19D423293G1 138-155 MHz
19D423293G2 150.8-174 MHz

SYMBOL	GE PART NO	DESCRIPTION
		- - - - - - CAPACITORS - - - - - -
[illegible]	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW. sim to RMC Type JF Discap.
[illegible] C138L	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
[illegible]	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
[illegible]	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
[illegible]	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
[illegible]	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
[illegible]	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW. sim to RMC Type JF Discap.
[illegible]	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
[illegible]	19A116656P106J7	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
[illegible]	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible] C144	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
[illegible]	5490008P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible]	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
[illegible]	5493366P680J	Mica: 680 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
[illegible]	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible]	5490008P31	Silver mica: 150 pf ±5%, 500 VDCW, sim to Electro Motive Type DM-15.
[illegible]	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
[illegible]	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible]	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
[illegible] C124L	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C124M	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible]	5494481P113	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
[illegible] C128R	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
C128L	5491601P119	Phenolic: 0.82 pf ±5%, 500 VDCW.
[illegible] C129	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
[illegible] C130L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C130R	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible]	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
[illegible] C131L	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM
C131R	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.

SYMBOL	GE PART NO.	DESCRIPTION
[illegible]	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
[illegible]	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C135R	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C135L	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible]	7489162P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible] C137	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
[illegible] C137	5496267P1L	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
[illegible] C138R	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C138R	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C139L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C139R	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
[illegible] C140L	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
[illegible] C140R	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
[illegible]	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
[illegible] C141R	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
[illegible] C142	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
[illegible] C143	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW, sim to RMC Type JF Discap.
[illegible] C144	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
[illegible] C145	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
[illegible] C146L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C146R	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C147L	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C147R	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
[illegible] C148	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C149L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C149R	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
[illegible] CR101 thru CR102	5495769P8	Diode, silicon.
CR103	19A115250P1	Silicon
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J101	19A130924G1	Connector. Includes:
	19A116832P1	Receptacle, coaxial: jack type; sim to Cinch 14H1613.
J101-2	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 2).
J103	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L101	19C307171P101	Coil, RF.
L102L	19C307171P102	Coil, RF.
L102R	19C307171P101	Coil, RF.
L103	19B209420P130	Coil, RF: 27.0 µh ±10%, 3.60 ohms DC res max; sim to Jeffers 441316-5.

SYMBOL	GE PART NO.	DESCRIPTION
L104	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2.
L105	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max sim to Jeffers 4421-9.
L106	7488079P7	Choke, RF: 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4411-10.
L107	19B209420P123	Coil, RF: 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2.
L108	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4411-5.
		- - - - - - - - PLUGS - - - - - - - -
P102	19A116659P2	Connector, printed wiring: 10 contacts; sim to Molex 09-52-3102.
		- - - - - - - - TRANSISTORS - - - - - - - -
Q101	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q102	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q103	19A115910P1	Silicon, NPN. sim to Type 2N3904.
Q104 and Q105	19A115330P1	Silicon, NPN.
Q106	19A115328P1	Silicon, NPN.
Q107 and Q108	19A115329P2	Silicon, NPN.
		- - - - - - - - - RESISTORS - - - - - - - - -
R101	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R102	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R103	3R152P512J	Composition: 5100 ohms ±5%, 1/4 w.
R104	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R105	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R106	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R107	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R108	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R109	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R110	3R152P913J	Composition: 91,000 ohms ±5%, 1/4 w.
R111	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R112	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R113	3R152P474K	Composition: 0.47 megohm ±10%, 1/4 w.
R114	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R115	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R116	3R152P683K	Composition: 68,000 ohms ±10%, 1/4 w.
R117	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R118	3R152P152K	Composition: 1500 ohms ±10%, 1/4 w.
R119	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R120	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R121	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R122	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R123	3R152P271K	Composition: 270 ohms ±10%, 1/4 w.
R124	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R125	3R152P620J	Composition: 62 ohms ±5%, 1/4 w.
R126	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R127	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R128	3R152P390K	Composition: 39 ohms ±10%, 1/4 w.
R129	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R130	3R152P200J	Composition: 20 ohms ±5%, 1/4 w.
R131	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R132	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R133	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R134	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R135	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R136	19C314256P23162	Metal film: 31,600 ohms ±1%, 1/4 w.
R137	19C314256P21212	Metal film: 12,100 ohms ±1%, 1/4 w.
R138	19C314256P27871	Metal film: 7870 ohms ±1%, 1/4 w.
R139	19C314256P27151	Metal film: 7150 ohms ±1%, 1/4 w.
R140	3R152P563J	Composition: 56,000 ohms ±5%, 1/4 w
R141 and R142	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R143	3R152P100K	Composition: 10 ohms ±10%, 1/4 w.
		- - - - - - - - THERMISTORS - - - - - - - -
RT101	19C300048P7	Disc: 5000 ohms ±10%; sim to NL 1D103.
RT102	19C300048P6	Disc: 200,000 ohms ±10%; sim to NL 4D05I.
		- - - - - - - - - TRANSFORMERS - - - - - - - - -
T101	19C307170P301	Coil, RF
T102	19C307170P302	Coil, RF
T103 and T104	19C307170P303	Coil, RF
T105 and T106	19C307169P201	Coil, RF
T107 and T108	19C307170P304	Coil, RF
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U101	19D416542G2	Transmitter, Audio.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR101	4036887P9	Silicon, Zener.
		- - - - - - - - - SOCKETS - - - - - - - - -
XY101	19A116659P50	Connector, printed wiring: 6 contacts; sim to Molex 09-65-1061.
		- - - - - - - - CRYSTAL MODULE - - - - - - - -
		NOTE: When reordering, give GE Part Number and specify exact operating frequency needed.
Y101	19B226982G4	Tx. 5 PPM (138-155 MHz).
	19B226982G5	Tx. 5 PPM (150.8-174 MHz).
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19A129424G2	Can. (Used with L101, L102, T101-T103).
	4036555P1	Insulator, washer: nylon. (Used with Q107, Q108).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number of component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

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MOBILE RADIO

MAINTENANCE MANUAL
138—174 MHz EXCITER BOARD 19D423293G1, G2

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DESCRIPTION

The exciter uses seven transistors, a crystal module and an integrated circuit to provide 250 milliwatt of power to drive the PA assembly. The crystal module determines the (F1) transmitting frequency in single frequency applications.

In multi-frequency transmitters, the crystal modules for frequencies F2-F4 are located on the multi-frequency board.

The crystal frequency ranges from approximately 11.5 to 14.5 megahertz, and is multiplied 12 times.

Audio, supply voltages and control functions are connected from the system audio & squelch board to the exciter board through P902.

Centralized metering jack J103 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the multipliers, amplifier and the regulated 10 Volt supply.

CIRCUIT ANALYSIS

F1 OSCILLATOR CIRCUIT

A Colpitts oscillator comprised of Q102, a plug-in crystal module and associated components provides the fundamental operating frequency for the transmitter. The crystal module in the collector base circuit of Q102 is temperature compensated to maintain frequency stability within ±5 PPM over a temperature range of -30°C to +65°C. Compensation voltage is applied from compensator circuit Q101. The output of the oscillator is taken from the collector of Q102, buffered by Q103 and applied to modulator CR101 and CR102.

With the radio turned on and the PTT switch operated, +10 Volts is present on the Tx OSC lead at P902-1 and the emitter of oscillator Q102. R104 and R105 comprise a voltage divider network to establish the bias voltage for Q102, allowing it to oscillate at the crystal frequency.

SERVICE NOTE

Y1 and C2 are not field replaceable items. C2 is factory selected to compliment the temperature/frequency characteristics of each individual crystal. Should it become necessary to replace either Y1 or C2, the entire crystal module must be replaced.

In single frequency radios, the F1 keying lead is connected directly to A- by a DA jumper connected between H12 and H31 on the system, audio, squelch board (SAS). This assures F1 oscillator operation each time the PTT switch is pressed.

With the radio turned on and the PTT switch operated, +10 Volts is present on the transmitter oscillator lead at P902-1 and the emitter of Q102. R104 and R105 comprise a voltage divider network to establish the base voltage for Q102 allowing it to oscillate at the crystal frequency to allow E1 frequency selection via the frequency selector switch on the control unit.

When frequencies F2 thru F4 are selected the oscillator output frequency from the multi-frequency board is supplied to buffer Q103 through J102-1 on the exciter and cable W2601.

COMPENSATOR CIRCUITS

The crystal modules are temperature compensated at both ends of the temperature range to provide instant frequency compensation. The temperature compensator consists of Q101, VR101, RT101, RT102 and associated components. Zener diode VR101 provides a constant +8.5 V reference voltage for compensator Q101.

The cold end compensation circuit does not operate at temperatures above -10°C (+14°F). When the temperature drops below -10°C, the circuit is activated. As the temperature decreases, the resistance of RT101 decreases and the compensation voltage decreases.

An increase in compensation voltage decreases the capacitance of the varactor in the oscillator, thereby increasing the output frequency of the crystal module.

The hot end compensation circuit does not operate at temperatures below +55°C (131°F). When the temperature rises above +55°C, the circuit is activated. As the temperature increases, the resistance of RT102 decreases and the compensation voltage decreases. The decrease in compensation voltage increases the capacity of the varactor, decreasing the output frequency of the crystal module.

Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules. Voltages should be measured using a high impedance meter.

TEMPERATURE RANGE	OUTPUT VOLTAGE	
	MINIMUM	MAXIMUM
-30°	4.9 Volts	6.0 Volts
-10° to 50°C	3.7 Volts	4.3 Volts
+75°C	3.3 Volts	3.8 Volts

AUDIO IC

The transmitter audio circuitry is contained in audio IC U101. A simplified drawing of the audio IC is shown in Figure 1.

Audio from the microphone at pin 12 is coupled through pre-emphasis capacitor C1 to the base of Q1 in the operational amplifier-limiter circuit. Collector voltage for the transistorized microphone pre-amplifier is supplied from the 10-Volt regulator through R979 and R980 on the System-Audio-Squelch board to J901-14.

The operational amplifier-limiter circuit consists of Q1, Q2, and Q3. Q3 provides limiting at high signal levels. The gain of the operational amplifier circuit is fixed by negative feedback through R19, R20 and the resistance in the network (Pin 9).

The output of Q3 is coupled through a de-emphasis network (R10 and C3) to an active post-limiter filter consisting of C4, C5, C6, R11, R12, R13, R15, R17 and Q4.

Following the post-limiter filter is class A amplifier Q5. The output of Q5 is coupled through MOD ADJUST potentiometer R108 and resistors R109 and R115 to the phase modulators.

SERVICE NOTE: If the DC voltages applied to the audio IC are correct and there is no audio output, replace U101.

For radios equipped with Channel Guard, tone from the encoder is applied to the phase modulators through P902-9, (CG H1) and resistors R112 and R117. Instructions for setting Channel Guard modulation are located in the Transmitter Alignment Procedures.

BUFFER & PHASE MODULATOR

The oscillator output is coupled through buffer-amplifier Q103 to the modulator. The first phase modulator is varactor (voltage-variable capacitor) CR101 is connected in series with tunable coil L101.

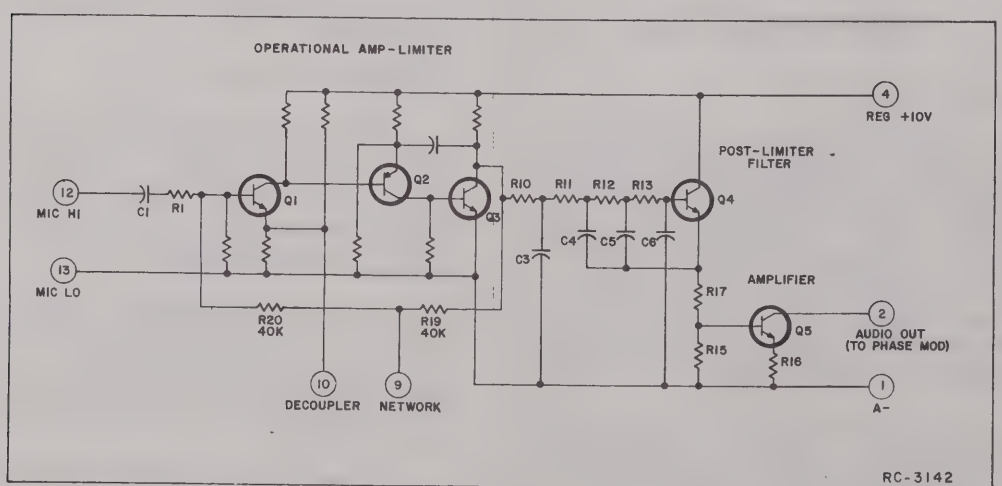


Figure 1 - Simplified Audio IC

CIRCUIT ANALYSIS

This network appears as a series-resonant circuit to the RF output of the oscillator. An audio signal applied to the modulator circuit through blocking capacitor C114 varies the bias of CR101, resulting in a phase modulated output. A voltage divider network (R109 and R113) provides the proper bias for varactors CR101 and CR102.

The output of the modulator is coupled through blocking capacitor C119 to the base of buffer Q104.

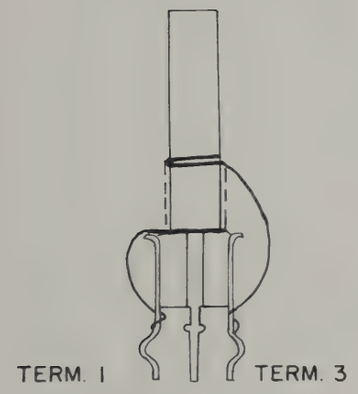
MULTIPLIERS & AMPLIFIER

Buffer Q104 is saturated when no RF signal is present. Applying an RF signal to Q104 provides a sawtooth waveform at its collector to drive class C tripler, Q105. The tripler stage is metered through R122. The output of Q105 is coupled through tuned circuits T101 and T102 to the base of doubler Q106. T101 and T102 are tuned to one-fourth of the operating frequency. The doubler stage is metered through R124.

The output of Q106 is coupled through tuned circuits T103 and T104 to the base of second doubler Q107. T103 and T104 are tuned to one-half the operating frequency. Q107 is metered through R129.

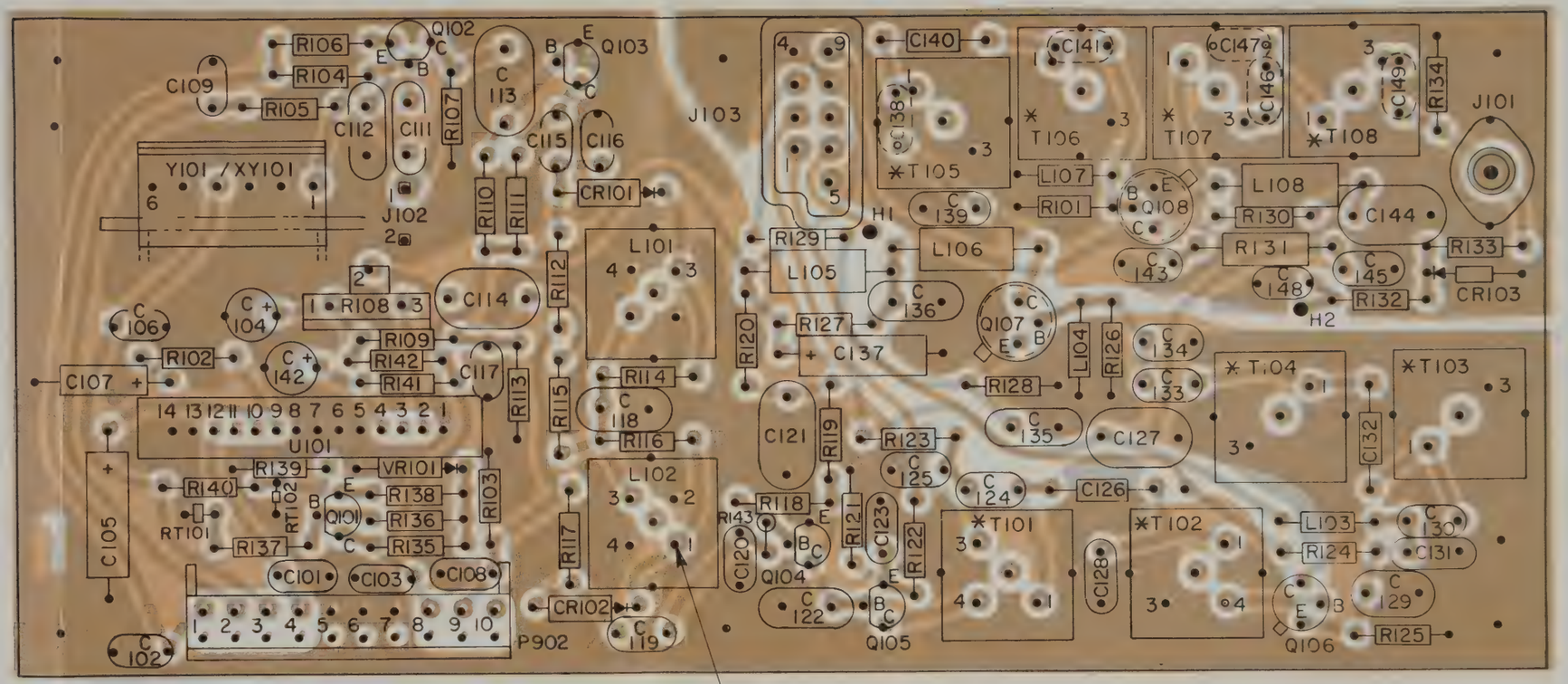
The output of Q107 is coupled through two tuned circuits (T105 and T106) to the base of amplifier Q109. These circuits are tuned to the transmitter operating frequency.

Q108 is a class C amplifier, and is metered through R130. The amplifier collector circuit consists of T107, C146, C147, T108 and C149, and matches the amplifier output to the input of the power amplifier assembly.



DETAIL "C"

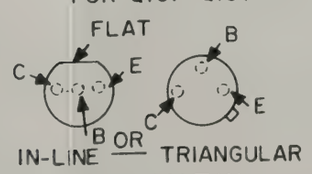
L101 & L102 (ENLARGED)



SEE DETAIL "C"

(19D423895, Rev. 0)
(19D423281, Sh. 2, Rev. 1)
(19D423281, Sh. 3, Rev. 1)

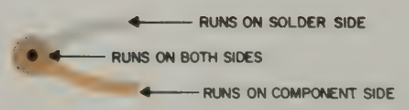
LEAD IDENTIFICATION
FOR Q101 - Q107



TOP VIEW

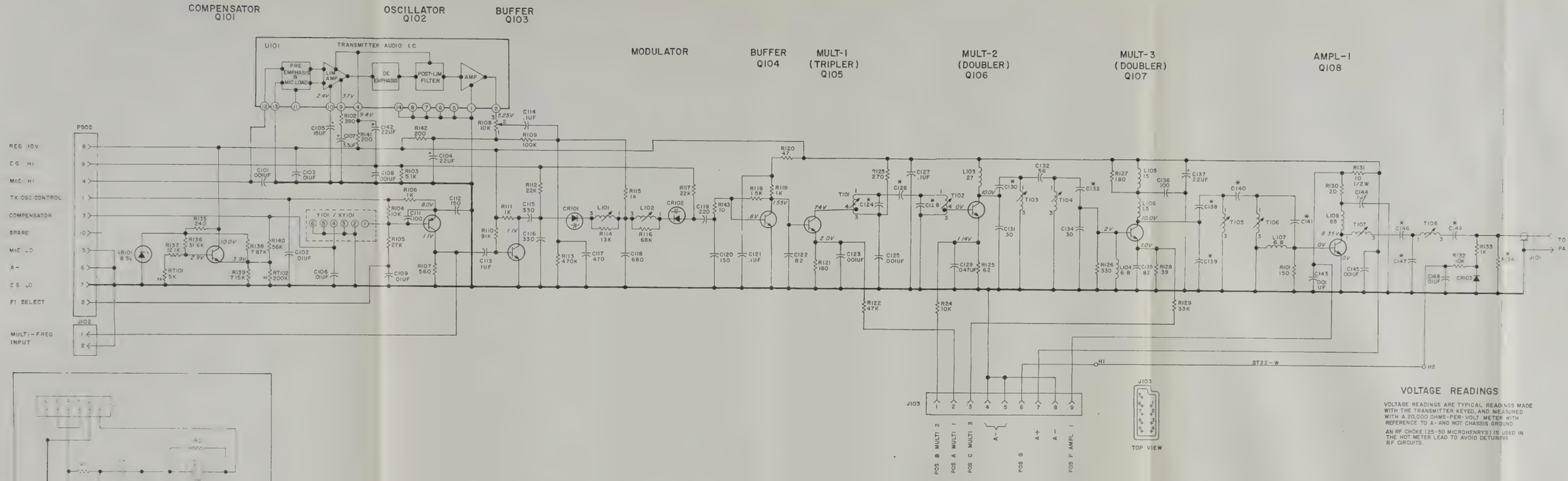
NOTE: LEAD ARRANGEMENT, & NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION TAB INDICATES EMITTER LEAD

✱ RAISED TAB ON COIL FORM INDICATES PIN 1 ON T101 THRU T108



OUTLINE DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2



EXCITER BOARD	REV LETTER	FREQ RANGE
19D423293G1	A	138 - 155 MHz
19D423293G2	A	150.8-174MHz

* SEE CHART BELOW FOR VALUE

COMPONENT IDENT	VALUE L 138 - 155	VALUE H 150.8-174
C124	30	24
C126	82	75
C128	27	24
C130	24	8
C133	24	18
C136	13	6
C139	27	18
C140	47	39
C4	9	6
C146	8	6
C147	13	10
C149	8	6
R134	390	NONE

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND.

AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS.

(19B622171, Rev. 4)

SCHEMATIC DIAGRAM

138—174 MHz EXCITER BOARD
19D423293G1, 2

Issue 2

PARTS LIST

LBI-30064A

136-174 MHz EXCITER BOARD
19D422093G1, 136-155 MHz
19D422093G2 150.8-174 MHz

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C101	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C102 and C103	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C104	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C105	5496267P14	Tantalum: 15 µf ±20%, 30 VDCW; sim to Sprague Type 150D.
C106	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C107	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C108	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C109	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C11.	19A116656P10627	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C112	7489102P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C113 and C114	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C115 and C116	5490008P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C117	5494481P107	Ceramic disc: 470 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C118	5493369P680J	Mica: 680 pf ±5%, 100 VDCW; sim to Electro Motive Type DM-15.
C119	5490008P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C120	5490008P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C121	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C122	7489102P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C123	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C124L	5496219P25C	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C124M	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C125	5494481P111	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C126M	5491601P118	Phenolic: 0.75 pf ±5%, 500 VDCW.
C126L	5491601P119	Phenolic: 0.82 pf ±5%, 500 VDCW.
C127	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C128L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C128M	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C129	19A116080P105	Polyester: 0.047 µf ±10%, 50 VDCW.
C130L	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C130M	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C131	5496219P25C	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
C132	5491601P115	Phenolic: 0.56 pf ±5%, 500 VDCW.
C133L	5496219P248	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef -80 PPM.
C133M	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C134	5496219P250	Ceramic disc: 30 pf ±5%, 500 VDCW, temp coef -80 PPM.
C135	7489102P25	Silver mica: 82 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C136	5490008P127	Silver mica: 100 pf ±10%, 500 VDCW; sim to Electro Motive Type DM-15.
C137	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C138L	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C138M	5496219P239	Ceramic disc: 8.0 pf ±5%, 500 VDCW, temp coef -80 PPM.
C139L	5496219P249	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef -80 PPM.
C139M	5496219P245	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef -80 PPM.
C140L	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C140M	5491601P111	Phenolic: 0.39 pf ±5%, 500 VDCW.
C141L	5496219P239	Ceramic disc: 8.0 pf ±5%, 500 VDCW, temp coef -80 PPM.
C1	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp -80 PPM.
C142	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C143	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C144	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C145	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C146L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C146M	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C147L	5496219P243	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C147M	5496219P241	Ceramic disc: 10 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C148	19A116080P1	Polyester: 0.01 µf ±20%, 50 VDCW.
C149L	5496219P239	Ceramic disc: 8.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
C149M	5496219P237	Ceramic disc: 6.0 pf ±0.25 pf, 500 VDCW, temp coef -80 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR101* and CR102*	5495768P9	Diode, silicon. Earlier than REV A:
	5495768P8	Diode, silicon.
CR103	19A115280P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J101	19A130924G1	Connector. Includes:
	19A116833P1	Receptacle, coaxial: jack type; sim to Cinch 14S11013.
J102	19A116779P1	Contact, electrical: sim to Molex 08-50-0404. (Quantity 2).
J103	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L101	19C307171P101	Coil, RF.
L102L	19C307171P102	Coil, RF.
L102M	19C307171P103	Coil, RF.
L103	19B209420P130	Coil, RF. 27.0 µh ±10%, 3.60 ohms DC res max; sim to Jeffers 4413L6-5.

SYMBOL	GE PART NO.	DESCRIPTION
L104	19B209420P123	Coil, RF. 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2.
L105	748G079P18	Choke, RF. 15.0 µh ±10%, 1.30 ohms DC res max; sim to Jeffers 4431-9.
L106	748G079P7	Choke, RF. 1.50 µh ±10%, 0.50 ohms DC res max; sim to Jeffers 4431-10.
L107	19B209420P123	Coil, RF. 6.80 µh ±10%, 1.80 ohms DC res max; sim to Jeffers 4446-2.
L108	748G079P5	Choke, RF. 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4431-5.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P902	19A116659P2	Connector, printed wiring: 10 contacts; sim to Molex 09-52-3102.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q101	19A116774P1	Silicon, NPN; sim to Type 2N5210.
Q102	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q103	19A115810P1	Silicon, NPN; sim to Type 2N3904.
Q104 and Q105	19A115330P1	Silicon, NPN.
Q106	19A115328P1	Silicon, NPN.
Q107 and Q108	19A115329P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R101	3R152P151J	Composition: 150 ohms ±5%, 1/4 w.
R102	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R103	3R152P513J	Composition: 5100 ohms ±5%, 1/4 w.
R104	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R105	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R106	3R152P103J	Composition: 1000 ohms ±5%, 1/4 w.
R107	3R152P561J	Composition: 560 ohms ±5%, 1/4 w.
R108	19B209358P106	Variable, carbon film: approx 300 to 10,000 ohms ±10%, 0.25 w; sim to CTS Type X-201.
R109	3R152P104K	Composition: 0.10 megohm ±10%, 1/4 w.
R110	3R152P913J	Composition: 91,000 ohms ±5%, 1/4 w.
R111	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R112	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R113	3R152P474K	Composition: 0.47 megohm ±10%, 1/4 w.
R114	3R152P133J	Composition: 13,000 ohms ±5%, 1/4 w.
R115	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R116	3R152P683K	Composition: 68,000 ohms ±10%, 1/4 w.
R117	3R152P223K	Composition: 22,000 ohms ±10%, 1/4 w.
R118	3R152P153K	Composition: 1500 ohms ±10%, 1/4 w.
R119	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R120	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R121	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R122	3R152P473K	Composition: 47,000 ohms ±10%, 1/4 w.
R123	3R152P271K	Composition: 270 ohms ±10%, 1/4 w.
R124	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R125	3R152P62GJ	Composition: 62 ohms ±5%, 1/4 w.
R126	3R152P331K	Composition: 330 ohms ±10%, 1/4 w.
R127	3R152P181K	Composition: 180 ohms ±10%, 1/4 w.
R128	3R152P390K	Composition: 39 ohms ±10%, 1/4 w.
R129	3R152P333K	Composition: 33,000 ohms ±10%, 1/4 w.
R130	3R152P200J	Composition: 20 ohms ±5%, 1/4 w.
R131	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.

SYMBOL	GE PART NO.	DESCRIPTION
R132	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R133	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R134	3R152P391K	Composition: 390 ohms ±10%, 1/4 w.
R135	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R136	19C314256P23162	Metal film: 31,600 ohms ±1%, 1/4 w.
R137	19C314256P21212	Metal film: 12,100 ohms ±1%, 1/4 w.
R138	19C314256P7871	Metal film: 7870 ohms ±1%, 1/4 w.
R139	19C314256P7151	Metal film: 7150 ohms ±1%, 1/4 w.
R140	3R152P563J	Composition: 56,000 ohms ±5%, 1/4 w.
R141 and R142	3R152P201J	Composition: 200 ohms ±5%, 1/4 w.
R143	3R152P100K	Composition: 10 ohms ±10%, 1/4 w.
		- - - - - - - - - - THERMISTORS - - - - - - - - - -
RT101	19C300064P7	Disc: 5000 ohms ±10%; sim to ML 12D13.
RT102	19C300064P5	Disc: 200,000 ohms ±10%; sim to ML 42D51.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T101	19C307170P301	Coil, RF.
T102	19C307170P202	Coil, RF.
T103 and T104	19C307170P303	Coil, RF.
T105 and T106	19C307169P201	Coil, RF.
T107 and T108	19C307170P304	Coil, RF.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - - -
U101	19D416542G2	Transmitter, Audio.
		- - - - - - - - VOLTAGE REGULATORS - - - - - - - -
VR101	403G687P9	Silicon, Zener.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY101	19A116659P50	Connector, printed wiring: 6 contacts; sim to Molex 09-63-1061.
		- - - - - - - - - - CRYSTAL MODULE - - - - - - - - - -
Y101	19B226993G4	NOTE: When reordering, give GE Part Number and specify exact operating frequency needed. Tx. 5 PPM (136-155 MHz).
	19B226992G5	Tx. 5 PPM (150.8-174 MHz).
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A129424G2	Can. (Used with L101, L102, T101-T108).
	403G555P1	Insulator, washer: nylon. (Used with Q107, Q108).

PRODUCTION CHANGES

Changes to the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Exciter Board 19D422093G1 & G2

To improve tuning on high end of frequency band. Changed CR101 and CR102.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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MOBILE RADIO

CUSTOM MVP
MAINTENANCE MANUAL
138-174 MHz, 25-WATT TRANSMITTER

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DESCRIPTION AND MAINTENANCE	LBI30142 (DF3164)
EXCITER	LBI30053 (DF3165)
POWER AMPLIFIER	LBI30143 (DF3166)

GENERAL ELECTRIC

Maintenance Manual LBI30141B
(DF3164, THIS SHEET ONLY)
138-174 MHz, 25-WATT
Custom MVP TRANSMITTER

SPECIFICATIONS*

FCC FILING NO.	KT-134-A
Power Output	25 Watts (Adjustable from 8 to 25 Watts)
Crystal Multiplication Factor	12
Frequency Stability	±0.0005%
Spurious and Harmonic Emission	-60 dB
Modulation	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
Modulation Sensitivity	75 to 120 Millivolts
Audio Frequency Characteristics	Within +1 to -3 dB of a 6-dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.
Distortion	Less than 5% (300 to 3000 Hz)
Deviation Symmetry	0.5 kHz maximum

Maximum Frequency Spread:

	Full Specifications	1 dB Degradation
138-155 MHz	1.8 MHz	2.25 MHz
150.8-174 MHz	2.0 MHz	2.5 MHz

Duty Cycle	EIA 20% Intermittent
RF Output Impedance	50 ohms

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

WARNING

Although the highest DC voltage supplied to the transmitter is +12 VDC, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized 12-Volt circuits!

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

MOBILE RADIO

DESCRIPTION AND MAINTENANCE
138—174 MHz MASTR CUSTOM MVP TRANSMITTER

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- Alignment Procedure ..... Page 5
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  - Tone Deviation ..... Page 6
  - Voice Deviation ..... Page 6
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DESCRIPTION

MASTR Custom MVP transmitters are crystal controlled, phase modulated transmitters designed for one through four frequency operation in the 138-174 MHz frequency band. This solid state, high reliability transmitter uses one integrated circuit and discrete components to provide 25 watts of transmitted RF power. The transmitter consists of:

- Exciter Board; with oscillator, audio, modulator, amplifier and multiplier stages.
- Power Amplifier Assembly; with amplifier, PA final, power control, and low pass filter and relay assembly.
- Multi-frequency board; used with multi-frequency radios only (common to transmitter and receiver).

Figure 1 is a block diagram of the MASTR Custom MVP transmitter showing the exciter, PA board and multi-frequency board.

The exciter contains the oscillator, audio IC, modulator and multipliers to provide 250 milliwatts of modulated RF power to the power amplifier.

The power amplifier assembly includes two transistor stages (amplifier and power amplifier) to provide rated output power, a low pass filter and relay, and a power adjust circuit to adjust the output power level.

MAINTENANCE

DISASSEMBLY

- To service the transmitter remove the wing nut at the rear of the radio and pull radio out of case assembly.
- To remove exciter board:
  (1) Unplug cables W201 (exciter output) and when present W2602 (multi-frequency cable).
  (2) Remove the six screws holding the exciter board to the mounting frame and gently lift exciter board out of radio.

NOTE

When replacing the PA board it is necessary to first remove the exciter board to allow installation of the PA transistor mounting hardware.

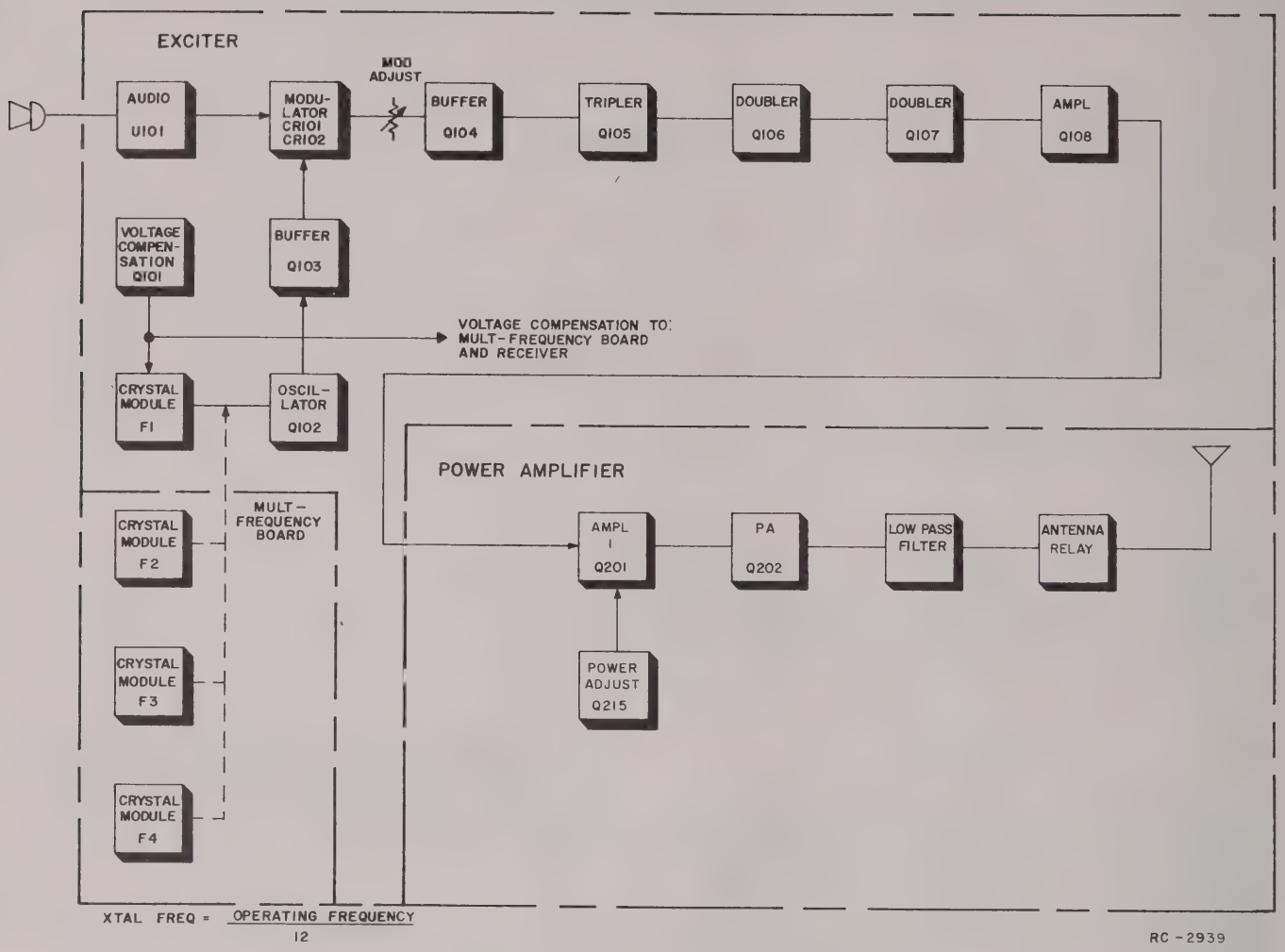


Figure 1 - Transmitter Block Diagram

To remove PA board:

1. Unplug the exciter/PA cable from J1. Then unsolder the center conductor of the PA/low pass filter cable W202 from H1. The shield will come loose when the PA board mounting screws are removed.

2. Unsolder power lead W203 at E2, and remove the retaining screw from power adjust transistor Q215. Be careful not to damage the mica insulator between the transistor and the chassis.

3. Remove the two screws securing each of the two flange transistors to the mounting shelf.

4. Remove the five PA board mounting screws, and lift the board out.

PA TRANSISTOR REPLACEMENT

WARNING

The stud mounted RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

To replace the PA RF transistors:

1. Remove exciter and PA boards.

2. Unsolder one lead at a time with a 50-watt soldering iron. Use a scribe or X-acto® knife to hold the lead away from the printed circuit board until the solder cools.

3. Lift out the transistor, and remove the old solder from the printed circuit board with a de-soldering tool such as a SOLDA PULLT® . Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.

4. Trim the new transistor leads (if required) to the lead length of the removed transistor. The letter "C" on the top of the transistor also indicates the collector (see Figure 2).

5. Apply a coat of silicon grease to the transistor mounting surface. Place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then hold the body of the transistor and replace the transistor mounting hardware, using moderate torque (6 inch-pounds). A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

6. Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

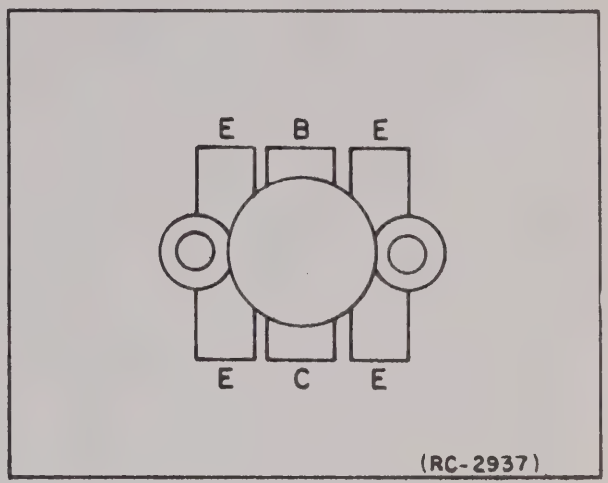


Figure 2 - Lead Identification

TROUBLESHOOTING

A Troubleshooting Procedure, including QUICK CHECKS, permits rapid fault location in the exciter and power amplifier.

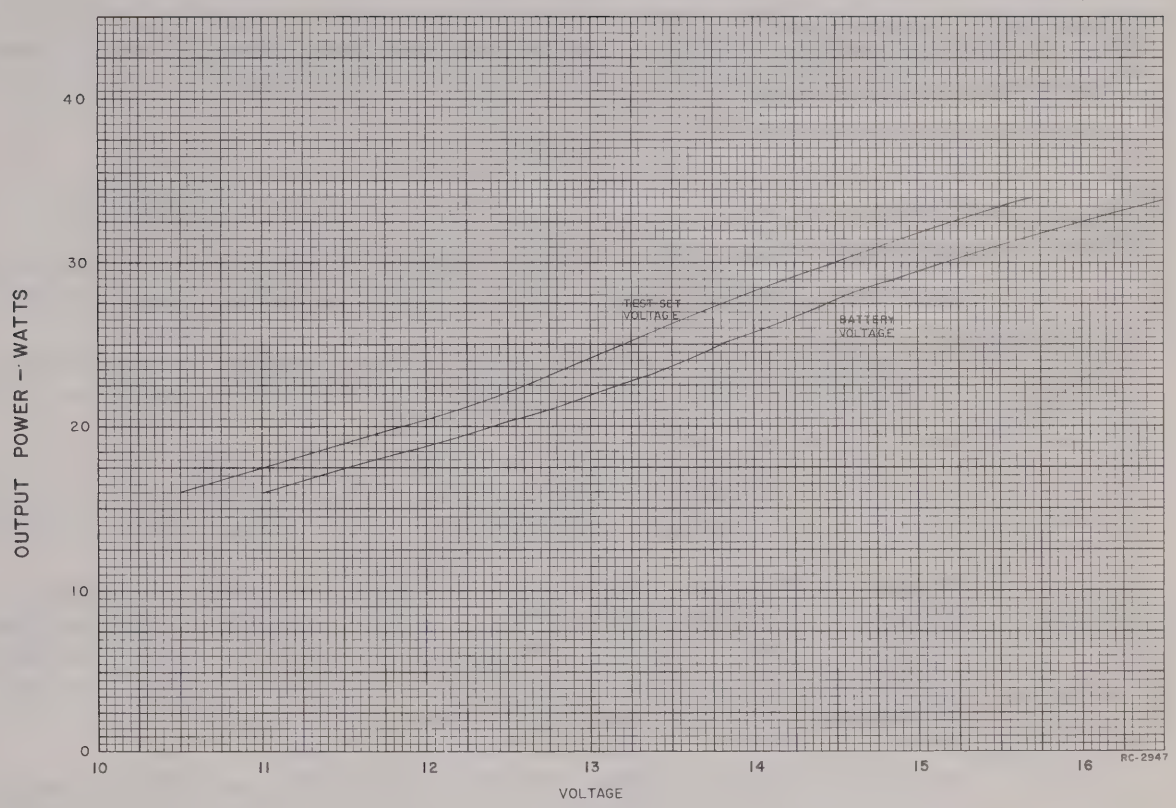


Figure 4 - Power Output Setting Chart

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST (R108) was adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average voice level. The audio peaks which would cause over-modulation are clipped by the modulation limiter. The limiter, in conjunction with the de-emphasis network, instantaneously limits the slope of the audio wave to the modulator, thereby preventing over-modulation while preserving intelligibility.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A frequency modulation monitor
3. An output meter or a VTVM
4. GE Test Set Model 4EX3A11 or 4EX8K12

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Hi) and J11 (Black-LO) on GE Test Set, or across P902-4 (Mike High) through a 0.5 microfarad (or larger) DC blocking capacitor, and P902-5 (Mike-Low) on the Exciter board.
2. Adjust the audio oscillator for 1-Volt RMS at 1000 Hz.
3. For transmitters without Channel Guard, set MOD ADJUST R108 for a 4.5 kHz swing using the deviation polarity that provides the highest reading on the frequency modulation monitor.
4. For transmitters with Channel Guard, set Channel Guard MOD ADJUST R1060 for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R108 for 3.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R1060 for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, set the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA supply voltage and PA current using the following formula:

$$P_i = \text{PA voltage} \times \text{PA current}$$

where:

P_i is the power input in watts,

PA voltage is measured with Test Set Model 4EX3A11 in Position G on the 15-Volt range (read as 15 Volt full scale), and with the polarity switch in the (–) position. With Test Set Model 4EX8K12, use the B+ position and the 1-Volt range (read as 15 Volts full scale), with the HIGH SENSITIVITY button and the polarity switch in the (–) position.

PA current is measured with the Test Set in Position F in the Test 1 position, and with the HIGH SENSITIVITY button pressed (read as 10 amperes full scale).

Example:

P_i = 12.6 Volts x 2 amperes = 25 Watts

OSCILLATOR FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set using a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 30°C (86°F).

The oscillator should be reset only when the frequency shows deviation in excess of the following limits:

A. ±0.6 PPM, when the radio is at 30°C (86°F).

F. ±5 PPM at any other temperature within the range of –30°C to +75°C (–22°F to +167°F)

If an adjustment is required, proceed as follows:

If the radio is at an ambient temperature of 30°C (86°F), set the oscillator for the correct operating frequency.

If the radio is not at an ambient temperature of 30°C, setting errors can be minimized as follows:

A. To hold the setting error to ±0.6 PPM (which is considered reasonable for 5 PPM crystal oscillators):

1. Maintain the radio at 30°C and set the oscillator to desired frequency, or
2. Maintain the radio at 30°C (+5°C, –15°C) offset the operating frequency as a function of actual temperature, by the amount shown in Figure 3.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 225 Hz.

Set C3 on the selected crystal module for a reading of 225 Hz higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 30°C), set the oscillator for the indicated frequency lower than the licensed operating frequency.

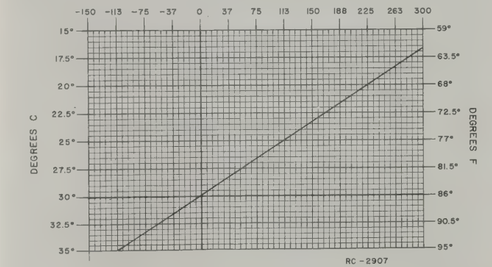
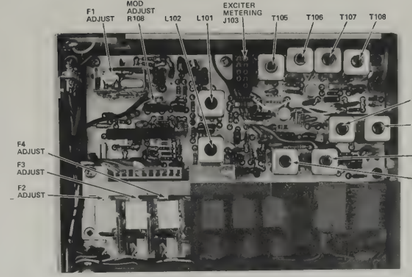
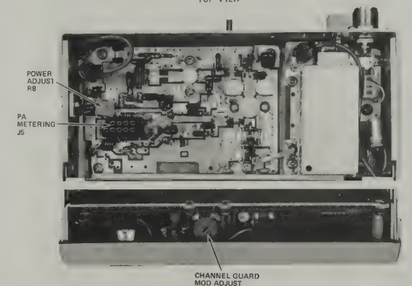


Figure 3 - Frequency Characteristics Vs. Temperature

BOTTOM VIEW



TOP VIEW



TRANSMITTER ALIGNMENT

EQUIPMENT

1. GE Test Set Model 4EX3A11 or Test Kit 4EX8K12.
2. A 50-ohm wattmeter connected to antenna jack J3.
3. A frequency counter.
4. Deviation monitor.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal modules for F1 on Exciter Board and F2-F4 on multi-frequency board. (Crystal frequency = operating frequency ÷ 12).
2. For a large change in frequency or a badly mis-aligned transmitter, preset all slugs to the top of the coil form.
3. For multi-frequency transmitters with a frequency spacing less than .900 MHz for frequencies between 129-155 MHz or less than 1.00 MHz for frequencies between 150.8-174 MHz tune the transmitter (except L101 and L102) do the lowest frequency. See Step 1 below.

   For multi-frequency transmitters with a frequency spacing up to 1.8 MHz for frequencies between 138-155 MHz or 2.0 MHz for frequencies between 150.8-174 MHz. Tune the transmitter using a center frequency tune-up crystal module. These limits can be extended to 2.25 MHz and 2.5 MHz respectively with 1 dB degradation in power output.
4. Connect the black probe to the Exciter metering jack. Set the polarity to +, and set the range to the Test 1 position (1-Volt position for 4EX8K12).
   NOTE: With the Test Set connected to the PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 10 amperes full scale.
5. All adjustments are made with the transmitter keyed. Unkey the transmitter between steps to avoid unnecessary heating.
6. Set tuning slugs in L101, L102 and T101 through T108 to top of coil form.

ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
1.	A (MULT-1)	L101, L102 & T101	See Procedure	Tune L101 then L102 for maximum meter reading on highest frequency. Then with lowest frequency selected, tune T101 for a dip in meter reading.
2.	A	L102	See Procedure	Using a deviation monitor, check the symmetry of the modulator at 300 Hz using the highest and lowest assigned operating frequencies. If more than 0.5 kHz diasymmetry exists, tune L102 to optimize symmetry. NOTE: L102 should not be adjusted more than ±1/8 turn from previous setting. If a deviation monitor is not available, adjust L102 1/8 turn counter-clockwise.
3.	B (MULT-2)	T102, T101 & T103	See Procedure	Tune T102 for maximum meter reading and re-adjust T101 for maximum meter reading. Then tune T103 for a dip in meter reading.
4.	C (MULT-3)	T104, T103 & T105	See Procedure	Tune T104 for maximum meter reading and re-adjust T103 for maximum meter reading. Then tune T105 for a dip in meter reading.
5.	F (AMPL-1)	T106 & T105	Maximum	Tune T106 for maximum meter reading, and then re-adjust T105 for maximum meter reading.
6.	G (Rel. Power Out)	T107 & T108	Maximum	Tune T107 and then T108 for maximum meter reading. Then, alternately re-tune T107 & T108 for maximum meter reading.
7.	D (AMPL-1 Driver or PA)	T107 & T108	Maximum	Set the range selector switch to the Test 3 Position. Move the black metering plug to PA metering jack and re-adjust T107 and T108 for maximum meter reading.
8.	F (AMPL-1 DRIVE)	T105 & T106	Maximum	Set the range selector switch to the Test 1 Position. Move the black metering plug back to the Exciter metering jack and re-adjust T105 and T106 for maximum meter reading.
9.		R8		With the battery voltage at 13.6 Volts or the PA collector voltage at 13.0 Volts, set Power Adjust potentiometer R8 on the PA board for the desired power output from 8 to 25 Watts. If the battery voltage is not at 13.6 Volts or the collector voltage at 13.0 Volts and full rated output is desired (25 Watts at 13.6 Volts), set R8 for the output power according to the battery voltage or collector voltage shown in Figure 4. NOTE The PA collector voltage is measured as described in the PA POWER INPUT section.
		ADDITIONAL STEPS FOR TRANSMITTERS USING CENTER FREQUENCY TUNE-UP CRYSTAL MODULE		
10.	B (MULT-2)	T101 & T102	See Procedure	Check drive on highest and lowest frequency. If drive is lower on lowest frequency, preset the tuning slugs of T101 and T102 to top of coil form and retune for maximum meter reading. (0.1 Volt typical difference between lowest and highest frequency).
11.	C (MULT-3)	T103	See Procedure	Check drive on highest and lowest frequency. If drive is lower on lowest frequency, retune T103 for maximum meter reading on lowest frequency.
12.	G Rel. Power Out	T105	See Procedure	Retune T105 for equal drive on highest and lowest frequency. Note: For two frequency spread approaching maximum limits, a difference in drive may exist. If this occurs, be sure the lower frequency has greater drive. Repeat Step 9.

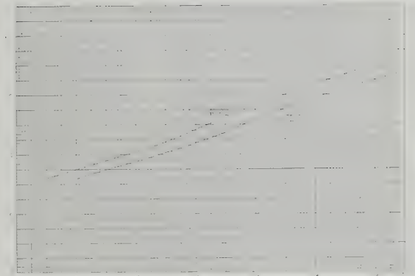


Figure 4 - Power Output Setting Chart

TEST PROCEDURES

These Test Procedures are designed to assist you in servicing a transmitter that is operating--but not properly. Problems encountered could be low power output, tone and voice deviation, defective audio sensitivity, and modulator adjust control set too high. Once a defect is pin-pointed, refer to the "Service Check" and the additional corrective measures included in the Transmitter Troubleshooting Procedure. Before starting with the Transmitter Test Procedures, be sure the transmitter is tuned and aligned to the proper operating frequency.

CAUTION

Before bench testing the MASTR Custom MVP Mobile Radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltages must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohm resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limits shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.8 VDC for loads of 0 to 6 amperes. Input voltages must not exceed the limits shown, even for transient peaks of short duration.

Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery.

TEST EQUIPMENT REQUIRED

for test hookup as shown:

1. Wattmeter similar to:
   Bird # 43
   Jones #711N
2. VTVM similar to:
   Triplett #850
   Heath # IM-21
3. Audio Generator similar to:
   GE Model 4EX6A10
4. Deviation Meter (with a .75 kHz scale) similar to:
   Measurements # 720

POWER MEASUREMENT

TEST PROCEDURE

1. Connect transmitter output from the antenna jack to the wattmeter through a 50-ohm coaxial cable. Make sure the wattmeter is terminated into a 50-ohm load.
2. Key the transmitter and check the wattmeter for the desired power output.

SERVICE CHECK

Check the setting of the Power Adjust Control (R8).

Refer to the QUICK CHECKS on the Transmitter Troubleshooting Procedure.

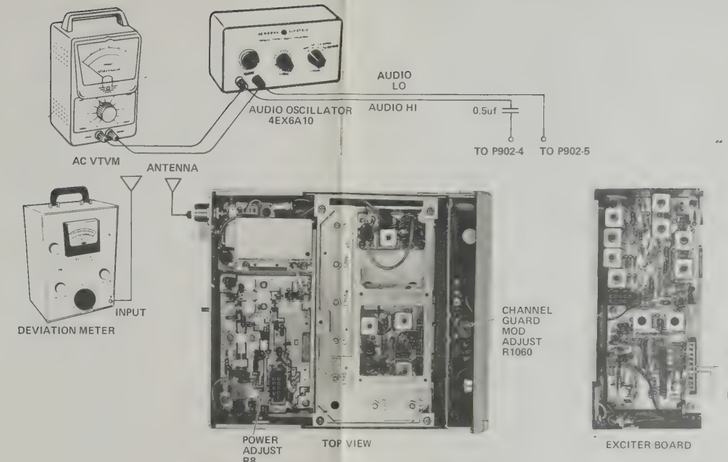
VOICE DEVIATION, SYMMETRY AND AUDIO SENSITIVITY

TEST PROCEDURE

1. Connect the test equipment to the transmitter as shown.
2. In radios equipped with Channel Guard set Channel Guard Mod Adjust R1060 for zero tone deviation.
3. Set the Audio generator output to 1.0 VOLTS RMS and frequency to 1 kHz.
4. Key the transmitter and adjust Deviation Meter to carrier frequency.
5. Deviation reading should be ±4.5 kHz in radios without Channel Guard, and ±3.75 kHz with Channel Guard.
6. If necessary, adjust MOD ADJUST control R108 (on exciter) for the proper deviation on plus (+) or minus (-) deviation, whichever is greater.

NOTES:-- MASTR Custom MVP transmitters are adjusted for 4.5 kHz deviation at the factory. The factory adjustment will prevent the transmitter from deviating more than 5.0 kHz under the worst conditions of frequency, voltage and temperature.

7. If the deviation reading plus (+) or minus (-) differs by more than 0.5 kHz, recheck Step 1 as shown in the Transmitter Alignment Chart.
8. Check Audio Sensitivity by reducing generator output until deviation falls to 3.0 kHz for radios without Channel Guard, or 2.25 kHz for radios with Channel Guard. Voltage should be LESS than 120 millivolts. If not, refer to the Transmitter Troubleshooting Procedure.



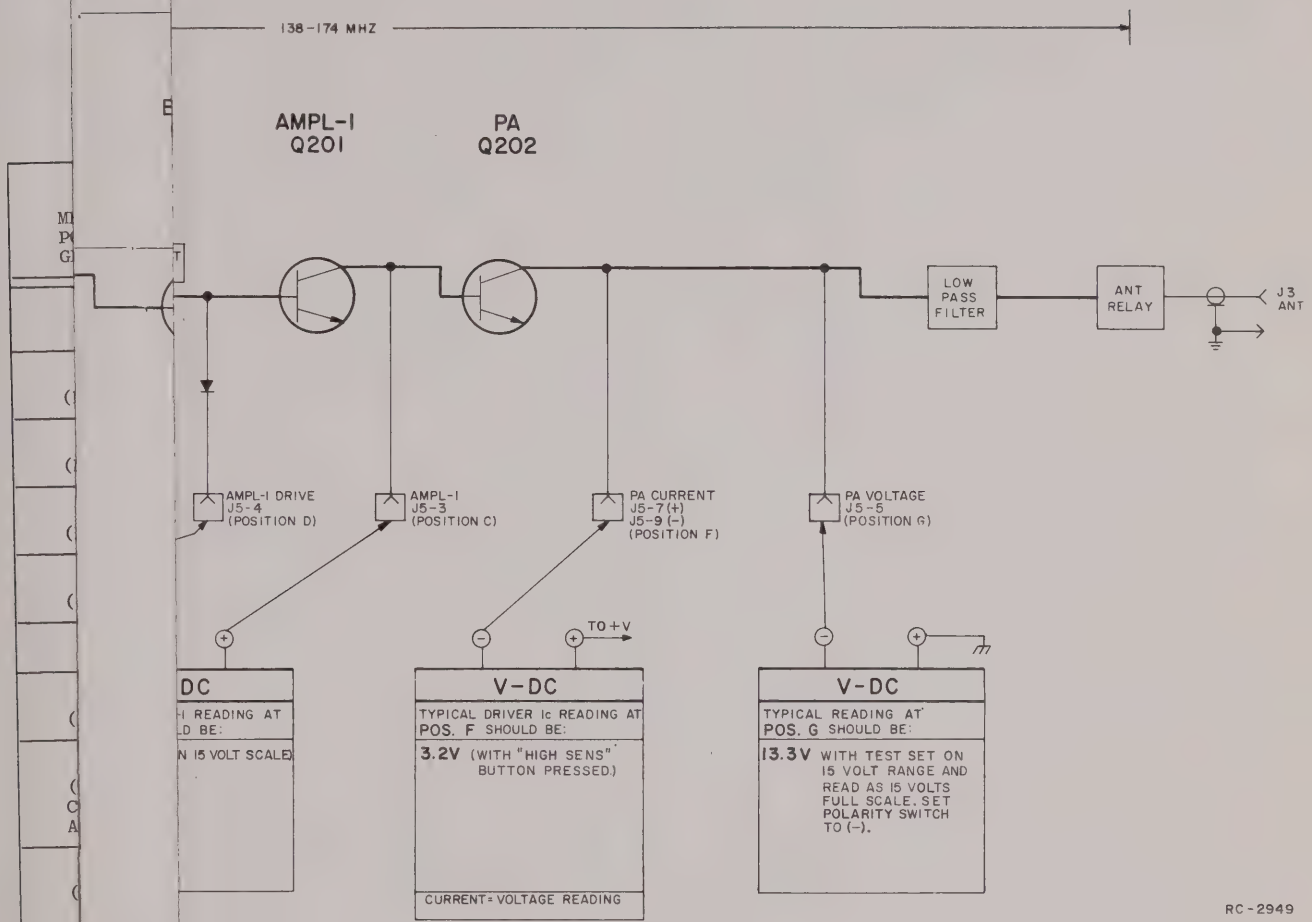
TONE DEVIATION WITH CHANNEL GUARD

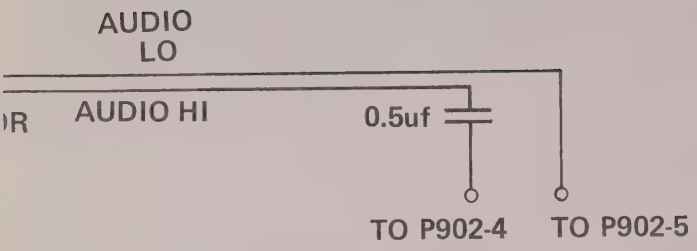
TEST PROCEDURE

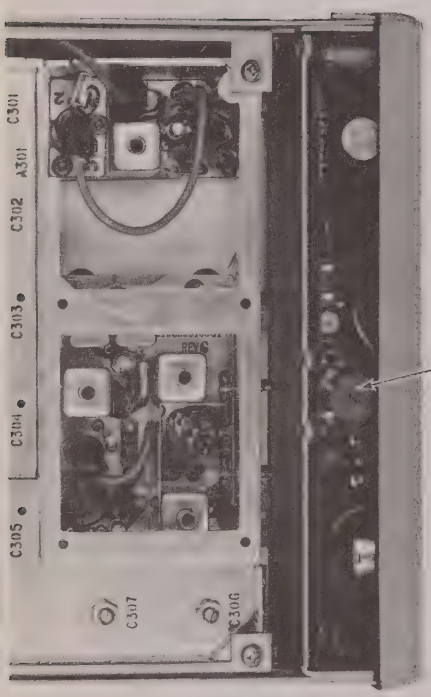
1. Set up the Deviation Meter and monitor the output of the transmitter.
2. Remove the 1000 Hz signal from the audio generator.
3. Key the transmitter and check for 0.75 kHz deviation. If the reading is low or high, adjust Channel Guard MOD ADJUST R1060 for a reading of 0.75 kHz.

NOTES:

1. On unit supplied with Channel Guard, the Phase Modulator Tuning should be adjusted carefully to insure proper performance. (Refer to Step 1 in the Transmitter Alignment Chart).

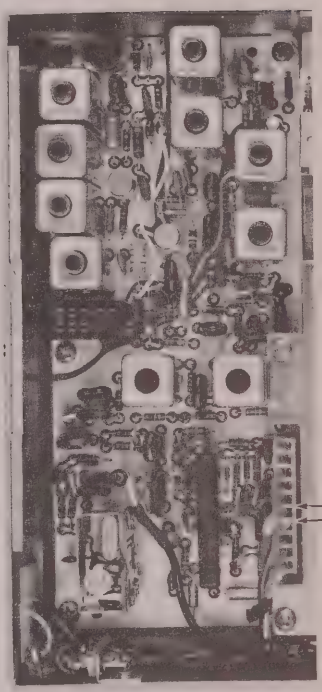

138-174 MHZ
AMPL-I
Q201
PA
Q202
LOW PASS FILTER
ANT RELAY
J3 ANT
AMPL-I DRIVE J5-4 (POSITION D)
AMPL-I J5-3 (POSITION C)
PA CURRENT J5-7(+) J5-9(-) (POSITION F)
PA VOLTAGE J5-5 (POSITION G)
TO +V
V-DC
TYPICAL DRIVER Ic READING AT POS. F SHOULD BE:
3.2V (WITH "HIGH SENS" BUTTON PRESSED)
CURRENT = VOLTAGE READING
V-DC
TYPICAL READING AT POS. G SHOULD BE:
13.3V WITH TEST SET ON 15 VOLT RANGE AND READ AS 15 VOLTS FULL SCALE. SET POLARITY SWITCH TO (-).
RC-2949





CHANNEL
GUARD
MOD
ADJUST
R1060

' VIEW



AUDIO
INPUT
P902-5
P902-4

EXCITER BOARD

1 CHANNEL GUARD

ıtput of the transmitter.

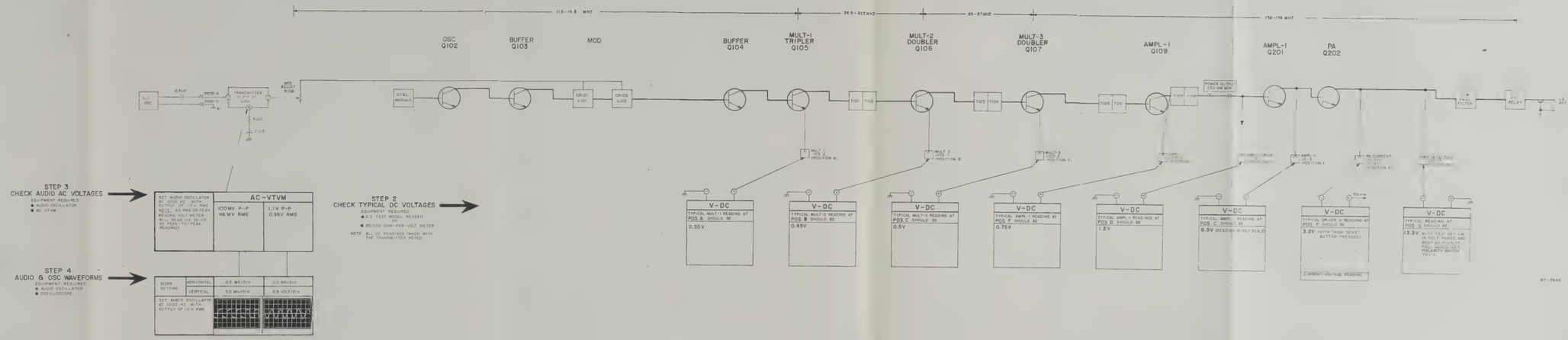
:rator.

:viation. If the reading is low or high,
'eading of 0.75 kHz.

:e Modulator Tuning should be adjusted carefully
) 1 in the Transmitter Alignment Chart).

STEP 1 - QUICK CHECKS

METER POSITION OR TEST SET	PROBABLE DEFECTIVE STAGE		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
A (MULT-1)	Q104, Q105 T101	Q104, Q105	Q104, Q105 T101
B (MULT-2)	Q106, T103	Q106, T101 T102	T101, T102, Q106, T103
C (MULT-3)	Q107, T105	T103, T104 Q107	T103, T104, Q107, T105
F (AMPL-1)	Q108, C149	T105, T106, Q108	T105, T106, Q108, L108
POWER AMPLIFIER			
"D" (AMPL-1 DRIVE)		Low Output from Exciter	No output from Exciter, CR1
"C" (AMPL-1 POWER CONTROL VOLTAGE)	Q201	Q201	No Exciter output, Q201, CR1
"F" (PA CURRENT)	Q201 Q202	Q201, Low Output from Q202	Q202, Q201. Check Pos. D & C
"G" (PA VOLTAGE)	Q202	Q201, Q202	Q202, Q201



ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-3164

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

138—174, 406—420 AND 450—512 MHz OSCILLATOR-MULTIPLIER BOARD 19C321981G1-6

138—174 MHz ADAPTER BOARD 19B227258G1

406—512 MHz MULTIPLIER BOARD 19C321998G1, 2

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DESCRIPTION

The Oscillator-Multiplier board for the General Electric CUSTOM MVP radio is used in the 138-174 MHz frequency band and also in the 406-420 and 450-512 MHz frequency bands. In addition to the oscillator-multiplier board, an adapter board is required on 138-174 MHz applications or a multiplier board in 406-512 MHz applications to complete the oscillator-multiplier chain to the mixer or IF filter boards.

The oscillator-multiplier board (Osc-Mult) contains a Colpitts oscillator, two multiplier stages and an amplifier. The operating frequency of the Colpitts oscillator is maintained within ±5 PPM by an externally compensated crystal module. The crystal frequencies range from approximately 14 to 18 megahertz and are multiplied nine times in the 138-174 MHz frequency band and 27 times in the 406-512 MHz frequency band to provide a low side injection frequency to the mixer.

CIRCUIT ANALYSIS

F1 OSCILLATOR CIRCUIT

Transistor Q402, a plug-in crystal module, trimmer capacitor, varicap and associated components comprise a Colpitts oscillator operating at the assigned F1 receive frequency.

The crystal module, located in the base circuit of Q402, is temperature compensated to maintain frequency stability over a temperature range of -30°C to +60°C. Compensation voltage from the exciter is applied through P602-1 to pin four of the crystal modules.

The compensation voltage varies non-linearly with temperature to complement the temperature-frequency characteristics of the crystal. Listed below are typical minimum and maximum voltage readings to be expected at pin 4 of the crystal modules, as measured with a high impedance meter.

TEMPERATURE RANGE	OUTPUT VOLTAGE	
	MINIMUM	MAXIMUM
-30°C	4.9 Volts	6.0 Volts
-10°C to +50°C	3.7 Volts	4.3 Volts
+75°C	3.3 Volts	3.8 Volts

Trimmer capacitor C3 is used to adjust the radio for the exact operating frequency. Refer to the Alignment Procedure for details.

Refer to the System Maintenance Manual for circuit details of the crystal modules.

SERVICE NOTE

Y1 and C2 are not field replaceable items. C2 is factory selected to complement the temperature/frequency characteristics of each individual crystal. Should it become necessary to replace either Y1 or C2, the entire crystal module must be replaced.

In single frequency applications, the F1 keying lead is wired to A- by a DA jumper wire connected between H8 and H9.

In multi-frequency radios this jumper is removed to allow F1 frequency selection via the frequency selector switch on the control panel.

With the radio turned on and the PTT switch released, +10 V is present on the Rx OSC control lead at P602-6 and the oscillator operates at the crystal frequency. Capacitor C402 provides the necessary in-phase feedback to sustain oscillations. A voltage divider network consisting of R407 and R408 sets the bias for oscillator transistor Q402.

C406 is tuned to three times the crystal frequency. The output of the tuned circuit is applied to the base of Class C multiplier Q403. The collector tank circuit of the multiplier (L402, C411, and C412) is tuned to nine times the crystal frequency. The output of the multiplier stage is metered across R411 and applied to receiver metering jack J601 through P602-3.

Following the multiplier is a Class A Amplifier stage, Q404. The output of Q404 is metered through a metering network consisting of C418, C420, CR401, R417 and R418 and applied to receiver metering jack J601 through P602-4. The amplifier output of Q404 is applied to a tuned circuit (L403 and C416) that is tuned to nine times the crystal frequency. The tuned circuit provides additional selectivity in the oscillator-multiplier chain.

In 138-174 MHz applications, the output of the oscillator-multiplier is coupled through C419 to the adapter board. The output of the adapter board is inductively coupled through L460 and two helical resonators on the RF assembly to the input of the mixer stage.

In 406-512 MHz applications, the output of the oscillator-multiplier is coupled through C419 to the base of Class C multiplier Q450 through a matching network (T450 and C451). The output of Q450 is inductively coupled to the first of three helical resonators through L451. The helicals are tuned to 27 times the crystal frequency by C306, C307, and C308. Most of the selectivity for the oscillator-multiplier chain is provided by the three high-Q helicals. The output of the helicals is applied to the source of mixer FET Q1 on the mixer board. The multiplier output is metered at J601-7 through a metering network on the IF-Filter board. The metering network consists of L505, L506, C512, C513, C514, CR501, and R506.

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-30°C	4.9 Volts	6.0 Volts
-10°C to +50°C	3.7 Volts	4.3 Volts
+75°C	3.3 Volts	3.8 Volts

Trimmer capacitor C3 is used to adjust the radio for the exact operating frequency. Refer to the Alignment Procedure for details.

Refer to the System Maintenance Manual for circuit details of the crystal modules.

SERVICE NOTE

Y1 and C2 are not field replaceable items. C2 is factory selected to complement the temperature/frequency characteristics of each individual crystal. Should it become necessary to replace either Y1 or C2, the entire crystal module must be replaced.

In single frequency applications, the F1 keying lead is wired to A- by a DA jumper wire connected between H8 and H9.

In multi-frequency radios this jumper is removed to allow F1 frequency selection via the frequency selector switch on the control panel.

CIRCUIT ANALYSIS

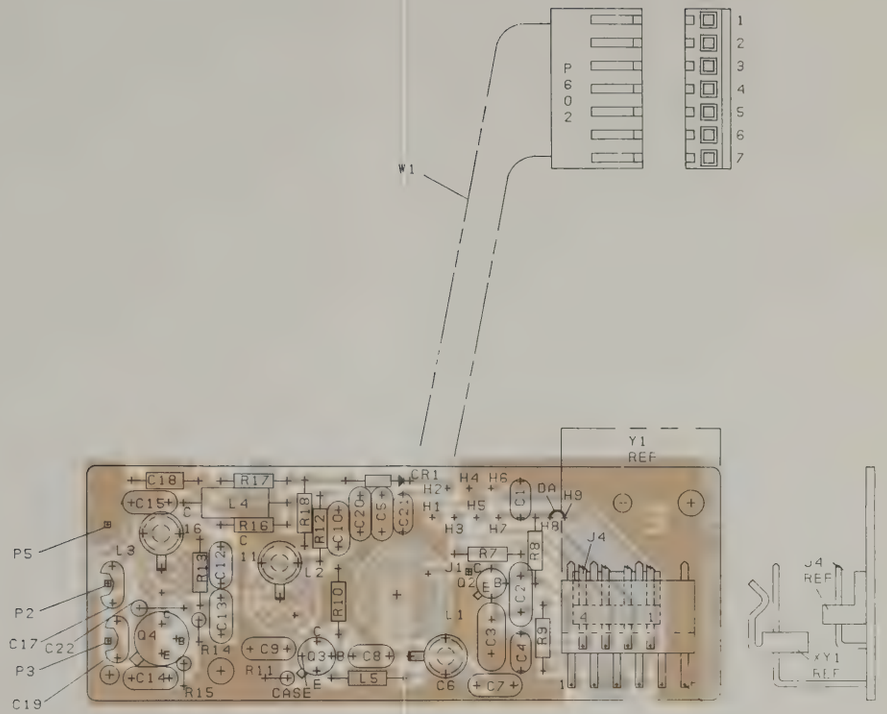
With the radio turned on and the PTT switch released, +10 V is present on the Rx OSC control lead at P602-6 and the oscillator operates at the crystal frequency. Capacitor C402 provides the necessary in-phase feedback to sustain oscillations. A voltage divider network consisting of R407 and R408 sets the bias for oscillator transistor Q402.

C406 is tuned to three times the crystal frequency. The output of the tuned circuit is applied to the base of Class C multiplier Q403. The collector tank circuit of the multiplier (L402, C411, and C412) is tuned to nine times the crystal frequency. The output of the multiplier stage is metered across R411 and applied to receiver metering jack J601 through P602-3.

Following the multiplier is a Class A Amplifier stage, Q404. The output of Q404 is metered through a metering network consisting of C418, C420, CR401, R417 and R418 and applied to receiver metering jack J601 through P602-4. The amplifier output of Q404 is applied to a tuned circuit (L403 and C416) that is tuned to nine times the crystal frequency. The tuned circuit provides additional selectivity in the oscillator-multiplier chain.

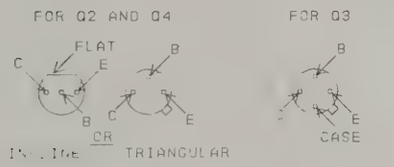
In 138-174 MHz applications, the output of the oscillator-multiplier is coupled through C419 to the adapter board. The output of the adapter board is inductively coupled through L460 and two helical resonators on the RF assembly to the input of the mixer stage.

In 406-512 MHz applications, the output of the oscillator-multiplier is coupled through C419 to the base of Class C multiplier Q450 through a matching network (T450 and C451). The output of Q450 is inductively coupled to the first of three helical resonators through L451. The helicals are tuned to 27 times the crystal frequency by C306, C307, and C308. Most of the selectivity for the oscillator-multiplier chain is provided by the three high-Q helicals. The output of the helicals is applied to the source of mixer FET Q1 on the mixer board. The multiplier output is metered at J601-7 through a metering network on the IF-Filter board. The metering network consists of L505, L506, C512, C513, C514, CR501, and R506.



(19C327105, Rev. 2)
(19B227247, Sh. 2, Rev. 2)
(19B227247, Sh. 3, Rev. 3)

LEAD IDENTIFICATION



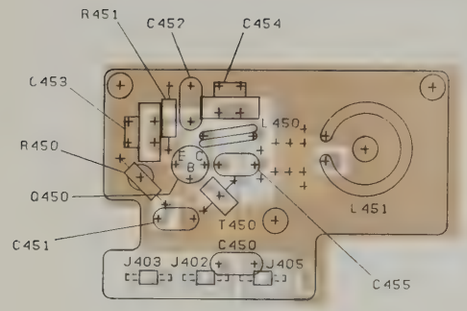
TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

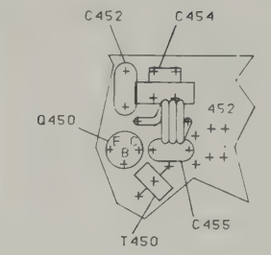
CONNECTION CHART	
WIRE	TO
W1-O	H1
W1-G	H2
W1-W	H3
W1-BK	H4
W1-R	H5
W1-BL	H6
W1-BR	H7

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 400 SERIES. EXAMPLE: J1= J401, C1= C401, R1= R401, ETC.

406—512 MHz MULTIPLIER BOARD

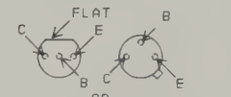


(19C327112, Rev. 2)
(19B227254, Sh. 2, Rev. 0)
(19B227254, Sh. 3, Rev. 0)



PARTIAL VIEW FOR GROUP 2

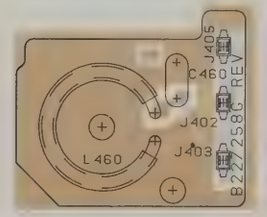
LEAD IDENTIFICATION FOR Q450



TOP VIEW

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

138—174 MHz ADAPTER BOARD



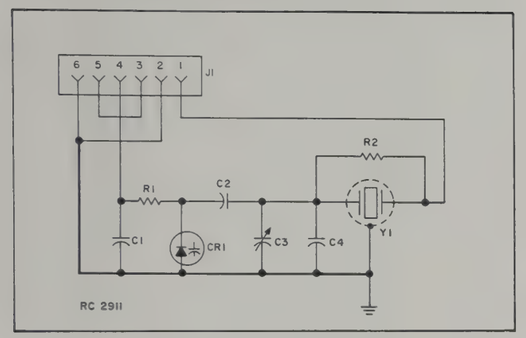
(19B227344, Rev. 0)
(19B227259, Sh. 2, Rev. 0)
(19B227259, Sh. 3, Rev. 0)

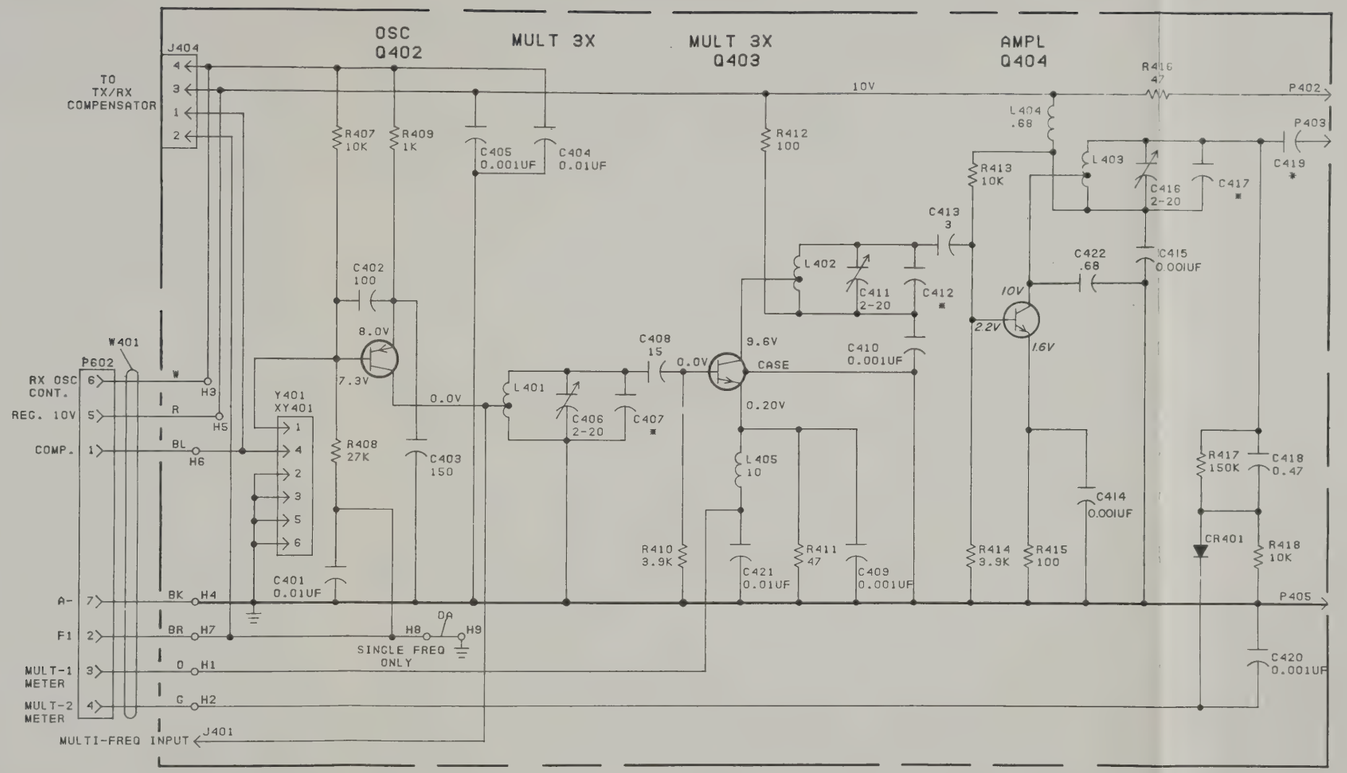
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

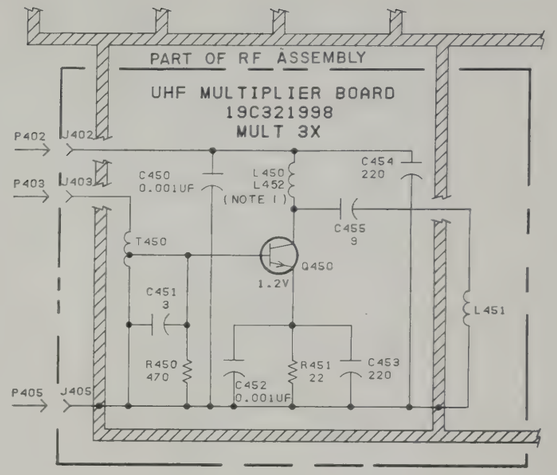
OUTLINE DIAGRAM

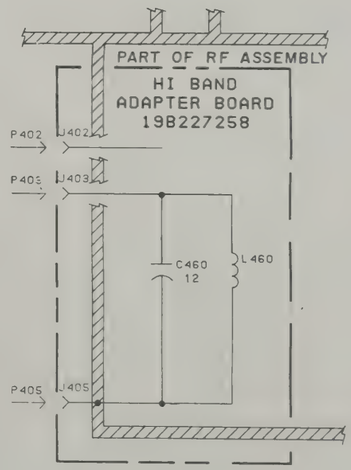
138—174 & 406—512 MHz
OSCILLATOR-MULTIPLIER

TYPICAL CRYSTAL MODULE









ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

NOTE: 1. L450 G1
L452 G2

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

	REV LETTER	FREQ RANGE (MHZ)
OSC/MULT BD		
19C321981G1	A	406-420
19C321981G2	A	450-470
19C321981G3	A	470-490
19C321981G4	A	494-512
19C321981G5	A	138-155
19C321981G6	A	150.8-174
MULT BD		
19C321998G1		450-512
19C321998G2		406-420
ADAPTER BD		
19B227258G1		138-174

*COMPONENT VALUE TABLE FOR OSCILLATOR/MULTIPLIER

COMPONENT DESIGNATION	406-420 MHZ LL	450-470 MHZ L	470-494 MHZ M	494-512 MHZ H	138-155 MHZ LA	150-174 MHZ HA
C407	27	20	18	15	24	18
C412	12	6	5	4	8	5
C417	7	3	–	–	3	–
C419	5	5	5	5	5	3

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P03-6) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

(19D423743, Rev. 4)

SCHEMATIC DIAGRAM

138—174 & 406—512 MHz
OSCILLATOR-MULTIPLIER

GE PART NO.	DESCRIPTION
	- - - - - - - - - - INDUCTORS - - - - - - - - - -
19A129280P1	Coil.
	406-512 MHz MULTIPLIER BOARD 19C321998G1 450-512 MHz 19C321998G2 406-420 MHz
	- - - - - - - - - - CAPACITORS - - - - - - - - - -
19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
19A116656P3K0	Ceramic disc: 3 pf ±1 pf, 500 VDCW, temp coef 0 PPM.
19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
19A116656P9K0	Ceramic disc: 9 pf ±1 pf, 500 VDCW, temp coef 0 PPM.
	- - - - - - - - JACKS AND RECEPTACLES - - - - - -
19A116428P4	Contact, electrical: sim to AMP 86031-1 (Strip Form).
19A116428P4	Contact, electrical: sim to AMP 86031-1 (Strip Form).
	- - - - - - - - - - INDUCTORS - - - - - - - - - -
19A129711P1	Coil.
19A129710P1	Coil.
19A129352P8	Coil.
	- - - - - - - - - - TRANSISTORS - - - - - - - - - -
19A116201P1	Silicon, NPN.
	- - - - - - - - - - RESISTORS - - - - - - - - - -
3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
3R152P220K	Composition: 22 ohms ±10%, 1/4 w.
	- - - - - - - - - - TRANSFORMERS - - - - - - - - -
19A129920G1	Coil.
	- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
4031594P1	Insulator: teflon. (Used with C6, C11, C16).
4036555P1	Insulator, washer: nylon. (Used with Q4).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Oscillator Multiplier Board 19C321981G1-6

Stop spurious oscillation in Amplifier Q404.
Added C422.

REV. B - Oscillator Multiplier Board 19C321981G6

REV. A - High Band Adapter Board 19B227258G1

To improve tuning at 174 MHz.
Changed C419 and C460

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

PARTS LIST

LBI-30153B

138-174, 406-420, 450-512 MHz
OSCILLATOR - MULTIPLIER
19C321981G1-G6

SYMBOL	GE PART NO.	DESCRIPTION
		19C321981G1 406-420 MHz (LL) 19C321981G2 450-470 MHz (L) 19C321981G3 470-494 MHz (M) 19C321981G4 494-512 MHz (H) 19C321981G5 138-155 MHz (LA) 19C321981G6 150.8-174 MHz (HA)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C401	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C402	5496218P763	Ceramic disc: 100 pf ±5%, 500 VDCW, temp coef -750 PPM.
C403	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C404	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C405	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C406	19B209351P2	Variable, ceramic: 2.5 to 20 pf, 200 VDCW, temp coef -250 +700 PPM/°C; sim to Matshushita ECV-1ZW20P32.
C407LL	19A116656P27J0	Ceramic disc: 27 pf ±5%, 500 VDCW, temp coef 0 PPM.
C407L	19A116656P20J0	Ceramic disc: 20 pf ±5%, 500 VDCW, temp coef 0 PPM.
C407M	19A116656P18J0	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
C407H	19A116656P15J0	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM.
C407LA	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C407HA	19A116656P18J0	Ceramic disc: 18 pf ±5%, 500 VDCW, temp coef 0 PPM.
C408	19A116656P15J0	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef 0 PPM.
C409 and C410	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C411	19B209351P2	Variable, ceramic: 2.5 to 20 pf, 200 VDCW, temp coef -250 +700 PPM/°C; sim to Matshushita ECV-1ZW20P32.
C412LL	19A116656P12J0	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef 0 PPM.
C412L	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C412M	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C412H	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C412LA	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C412HA	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C413	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C414 and C415	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C416	19B209351P2	Variable, ceramic: 2.5 to 20 pf, 200 VDCW, temp coef -250 +700 PPM/°C; sim to Matshushita ECV-1ZW20P32.
C417LL	19A116656P7J0	Ceramic disc: 7 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C417L	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C417LA	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C418	5491601P13	Phenolic: 0.47 pf ±10%, 500 VDCW.
C419LL	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C419L	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C419M	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C419H	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C419LA	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C419HA*	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		In REV A and earlier:
	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C420	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C421	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C422*	5491601P117	Phenolic: 0.68 pf ±5%, 500 VDCW. Added by REV A.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR401	19A115250P1	Silicon.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J401	19A116779P1	Contact, electrical: sim to Molex 08-50-0404.
J404	19A116659P118	Connector, printed wiring: 4 contacts; sim to Molex 09-88-2041.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L401 thru L403		(Part of printed board 19C321984P1).
L404	7488079P5	Choke, RF: 0.68 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4411-5K.
L405	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P402 and P403	19A116779P3	Contact, electrical: sim to Molex 08-50-0416.
P405	19A116779P3	Contact, electrical: sim to Molex 08-50-0416.
P602		(Part of W401).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q402	19A115852P1	Silicon, PNP; sim to Type 2N3906.
Q403	19A115440P1	Silicon, NPN.
Q404	19A115329P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R407	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R408	3R152P273J	Composition: 27,000 ohms ±5%, 1/4 w.
R409	3R152P102K	Composition: 1000 ohms ±10%, 1/4 w.
R410	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R411	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R412	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R413	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
R414	3R152P392K	Composition: 3900 ohms ±10%, 1/4 w.
R415	3R152P101K	Composition: 100 ohms ±10%, 1/4 w.
R416	3R152P470K	Composition: 47 ohms ±10%, 1/4 w.
R417	3R152P154K	Composition: 150,000 ohms ±10%, 1/4 w.
R418	3R152P103K	Composition: 10,000 ohms ±10%, 1/4 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W401	19B226965G2	Cable, includes (P602) 19A116659P82.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XY401	19A136694G1	Connector: 6 terminals.
		- - - - - 138-174 MHz CRYSTAL MODULE - - - - -
		NOTE: When reordering, give GE Part Number and specify exact operating frequency needed.
		For Standard Low Side Injection Frequency.
Y401	19B226962G13	Rx. 5 PPM. (138-155 MHz).
	19B226962G14	Rx. 5 PPM. (150.8-174 MHz).
		NOTE: For High Side Injection Frequency Using High Side Modification Kit 19A130045G1.
	19B226962G19	Rx. 5 PPM. (138-155 MHz).
	19B226962G20	Rx. 5 PPM. (150.8-174 MHz).
		HIGH SIDE INJECTION MODIFICATION KIT 19A130045G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C2301	19A116656P12K1	Ceramic disc: 12 pf ±10%, 500 VDCW, temp coef -150 PPM.
C2302 and C2303	19A116656P4K1	Ceramic disc: 4 pf ±1 pf, 500 VDCW, temp coef -150 PPM.
C2304	19A116656P10K1	Ceramic disc: 10 pf ±1 pf, 500 VDCW, temp coef -150 PPM.
C2305 and C2306	5491601P126	Phenolic: 2.2 pf ±5%, 500 VDCW.
C2311	19A116656P12K0	Ceramic disc: 12 pf ±10%, 500 VDCW, temp coef 0 PPM.
C2312	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2313	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C2314	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
		- - - - - 406-512 MHz CRYSTAL MODULE - - - - -
		NOTE: When reordering, give GE Part Number and specify exact operating frequency needed.
		For Standard Low Side Injection Frequency.
Y401	19B226962G15	Crystal module: 5 PPM, 406-420 MHz.
	19B226962G16	Crystal module: 5 PPM, 450-470 MHz.
	19B226962G17	Crystal module: 5 PPM, 470-494 MHz.
	19B226962G18	Crystal module: 5 PPM, 494-512 MHz.
		For High Side Injection Frequency:
Y401	19B226962G21	Crystal module: 5 PPM, 406-420 MHz.
	19B226962G22	Crystal module: 5 PPM, 450-470 MHz.
	19B226962G23	Crystal module: 5 PPM, 470-494 MHz.
	19B226962G24	Crystal module: 5 PPM, 494-512 MHz.
		138-174 MHz ADAPTER BOARD 19B227258G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C460*	19A116656P12K0	Ceramic disc: 12 pf ±10%, 500 VDCW, temp coef 0 PPM.
		Earlier than REV A:
	19A116656P18K0	Ceramic disc: 18 pf ±10%, 500 VDCW, temp coef 0 PPM.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J402 and J403	19A116428P4	Contact, electrical: sim to AMP 8603k-1 (Strip Form).
J405	19A116428P4	Contact, electrical: sim to AMP 8603k-1 (Strip Form).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L460	19A129280P1	Coil.
		406-512 MHz MULTIPLIER BOARD 19C321998G1 450-512 MHz 19C321998G2 406-420 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C450	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C451	19A116656P3K0	Ceramic disc: 3 pf ±1 pf, 500 VDCW, temp coef 0 PPM.
C452	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C453 and C454	19A116679P220K	Mica: 220 pf ±10%, 250 VDCW.
C455	19A116656P9K0	Ceramic disc: 9 pf ±1 pf, 500 VDCW, temp coef 0 PPM.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J402 and J403	19A116428P4	Contact, electrical: sim to AMP 86031-1 (Strip Form).
J405	19A116428P4	Contact, electrical: sim to AMP 86031-1 (Strip Form).
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L450	19A129711P1	Coil.
L451	19A129710P1	Coil.
L452	19A129352P8	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q450	19A116201P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R450	3R152P471K	Composition: 470 ohms ±10%, 1/4 w.
R451	3R152P220K	Composition: 22 ohms ±10%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T450	19A129920G1	Coil.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	4031594P1	Insulator: teflon. (Used with C8, C11, C16).
	4036555P1	Insulator, washer: nylon. (Used with Q4).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Oscillator Multiplier Board 19C321981G1-6
Stop spurious oscillation in Amplifier Q404.
Added C422.

REV. B - Oscillator Multiplier Board 19C321981G6
High Band Adapter Board 19B227258G1
To improve tuning at 174 MHz.
Changed C419 and C460

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

DF-1106

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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DESCRIPTION AND MAINTENANCE
406—420 & 450—512 MHz MASTR CUSTOM MVP RECEIVER

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DESCRIPTION

MASTR Custom MVP, 406-512 megahertz receivers are single conversion, superheterodyne FM receivers designed for one-through four-frequency operation. The solid state receiver utilizes integrated circuits (ICs), monolithic crystal filters and discrete components with each of the crystal filters located between gain stages to provide 85 dB selectivity and maximum protection from desensitization and intermodulation.

The receiver consists of the following modules:

- RF Assembly
- IF Filter Board
- Oscillator-Multiplier (Osc-Mult)
- Audio and Squelch circuits (part of System-Audio & Squelch (SAS) board)
- IF Detector (IF Det)
- Optional Ultra-High Sensitivity (UHS) Pre-Amplifier

Audio, supply voltages and control functions are connected to the system board through P903 on the IF Det board, and through W401 to the Osc-Mult board. The regulated +10 Volts is used for all receiver stages escept the audio PA stage which operates from the A+ system supply.

Centralized metering jack J601 on the IF Det board is provided for use with GE Test Set 4EX3A11 or Test Kit 4EX8K12. The test set meters the oscillator-multiplier, FM Detector, 10 Volts and IF amplifier stages.

A block diagram of the complete receiver is shown in Figure 1.

Refer to the appropriate Maintenance Manual for complete details on each receiver module as listed in the Table of Contents.

MAINTENANCE

DISASSEMBLY

To gain access to the receiver for servicing, remove the wing nut at the rear of the radio and pull the radio out of the case assembly.

To remove the RF Assembly and IF-Filter board:

1. Carefully disconnect the two leads connected to loop clips J623 and J624 on the IF Detector board.
2. Unplug wire W501 from J605 on IF Detector board.
3. Unplug receiver input cable P301.
4. Remove the two countersunk flat head screws on each side of the system frame assembly and lift out RF Assembly and IF-Filter board.

To remove the Osc-Mult board:

1. Remove the crystal module.
2. Remove the two screws securing the board.
3. Carefully unplug the Osc-Mult board from the adapter board (on the receiver front end).

To remove the IF Det board:

1. Carefully disconnect the two leads connected to loop clips J623 and J624 on the IF Det board.
2. Unplug wire W501 from J605 on the IF Det board.
3. Disconnect the two plugs (P602 and J903) from the IF Det Board.
4. Remove the five screws securing the board and lift the board out.

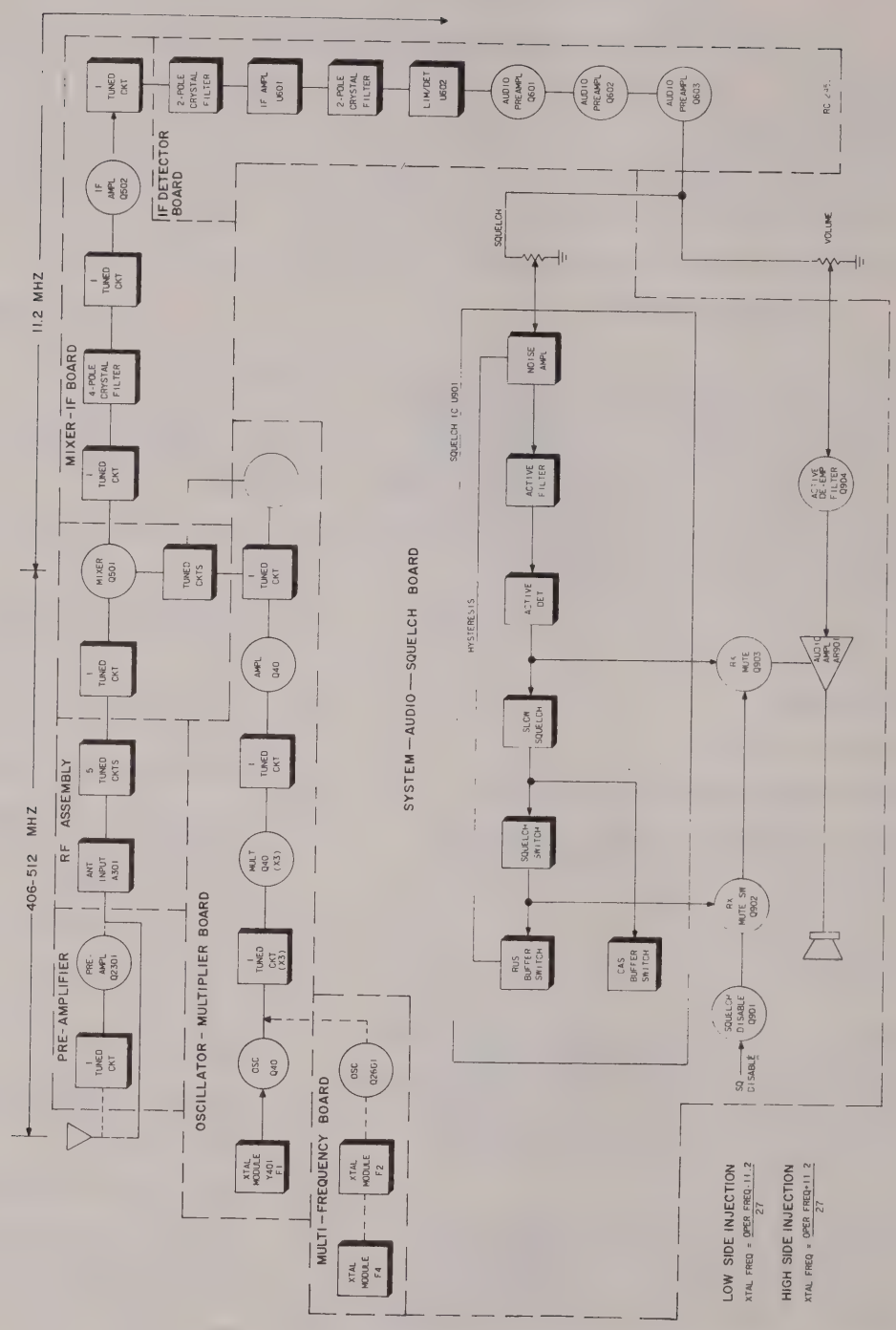
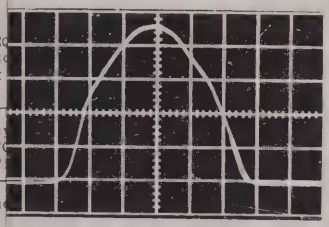
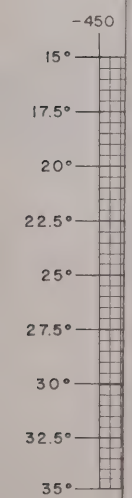


Figure 1 - Receiver Block Diagram

RING POSITION t	RING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
				MIXER & IF
				d IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, use e outlined in STEP 12.
				NOTE Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment is required.
		L507, L503, L504 and C504		Connect scope, signal generator and probe as shown in Figure 2. Set signal generator level for 3 to 5 uV and modulate with 10 kHz at 20 Hz. With probe between J601-1 and A-, tune L507, L503, L504 and C504 for double trace as shown on scope pattern.
		L504	Minimum	Apply a 1000 microvolt signal with 1 kHz modulation and 3.0 kHz deviation to the antenna jack. Connect a distortion analyzer to P903-1 (VOL/SQ HI) and monitor the distortion of the 1 kHz audio. Tune L504 for minimum distortion.
			See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7 kHz.
				SQUELCH ADJUST
		R901	30°	Set SQUELCH ADJUST control (R901) to open with a 6 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position).





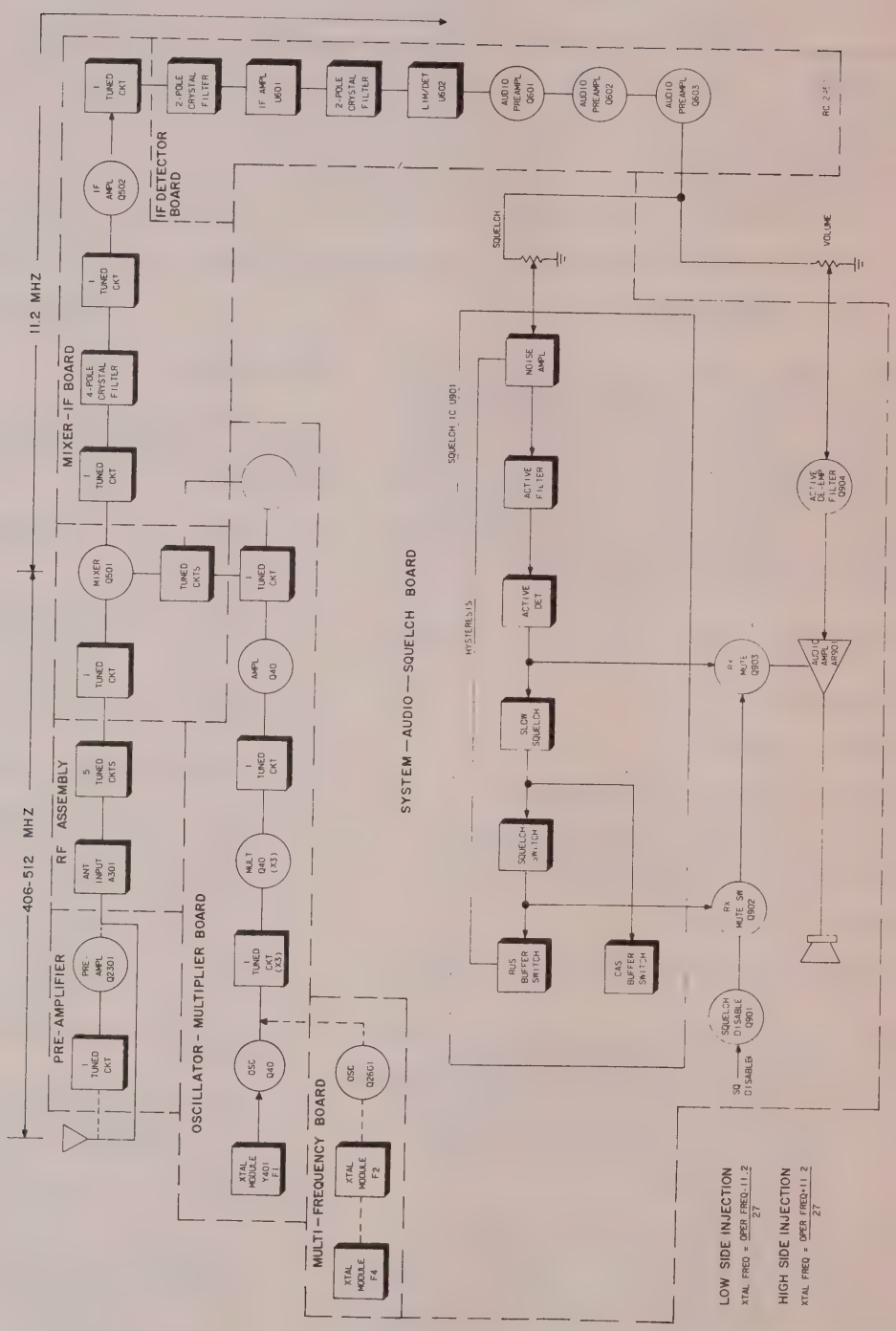


Figure 1 - Receiver Block Diagram

FRONT END ALIGNMENT

EQUIPMENT

1. GE Test Set Models 4EX3A11, 4EX8E12, or 20,000 ohms-per-Volt multimeter with a 1-Volt scale.
2. A 406-512 MHz signal source.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601. Set meter sensitivity switch to the TEST 1 position (or 1-Volt position on 4EX8E12).
2. For multi-frequency receivers with a frequency spacing up to 0.800 MHz for frequency range of 406-470 MHz, 0.900 MHz for frequency range of 470-494 MHz or 0.750 MHz for frequency range of 494-512 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than 1.60 MHz for frequency range of 406-470 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tune-up crystal module. These limits can be extended to 2.00 MHz, 2.00 MHz and 2.00 MHz respectively, with a 3 dB degradation in standard receiver specifications.
3. With the Test Set in Position G, check for regulated +10 Volts. If using multimeter, measure between J601-8 (+) and J601-7 (-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION GE Test Set	Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR-MULTIPLIER		
1.	A (4EX3A11)	Pin 2	C406	Maximum	Tune C406 for maximum meter reading.
2.			C411, C416, C606, C607 and C608	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C606, C607 and C608 fully counterclockwise. (Minimum capacity).
3.	B (4ELT-3)	Pin 4	C411, C416, C606 and C608	See Procedure	Tune C411 and C416 for maximum meter reading. Retune C411. Next, retune C406, C411 and C416 for maximum meter reading. Then carefully tune C608 for a change in meter reading (peak or dip).
4.	F (4ELT-3)	Pin 7	C606, C607 & C608	See Procedure	Carefully tune C607 and C608 for maximum meter reading. Repeak C607 and C606. Next, carefully tune C608 for minimum meter reading, and retune C606 for maximum meter reading. Do NOT readjust C607 or C608.
			RF SELECTIVITY		
5.	B (4EX3A11)	Pin 1	C301 thru C305, A303-C2, (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C305, C304 and C303 for maximum meter reading. In receivers with the UHB preamplifier, also tune L2301 for maximum meter reading.
6.	B (4EX8E12)	Pin 1	C301 thru C305, A303-C2, (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, A303-C2, (and L2301 if present) for best quieting sensitivity.

NOTE 1: Appendix A of DATAFILE Bulletin 1000-6 contains instructions for building a sweep modulator.

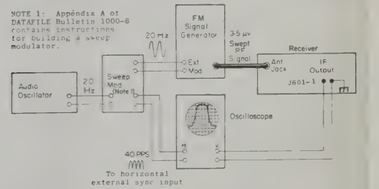
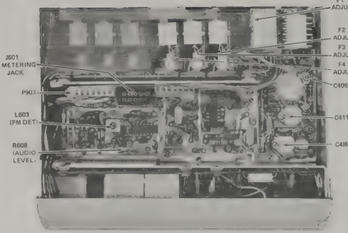
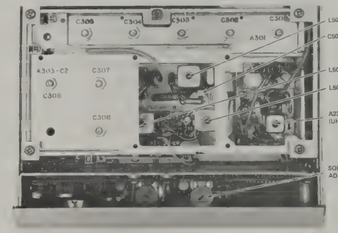


Figure 2 - Test Setup for 20-Hz Double-Trace Sweep Alignment





CRYSTAL MODULE FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. (Refer to frequency offset chart, Figure 3.) The frequency measurement requires equipment with an absolute accuracy that is better than the tolerance to be maintained. When adjusting the frequency, the entire radio should be as near as possible to an ambient temperature of 30°C (86°F).

The frequency of the crystal module should only be reset when the measured frequency error exceeds the following limits:

A. ±0.6 PPM when the ambient temperature of the radio is 30°C (86°F).

B. ±5 PPM at any other temperature within the range of -30°C to +75°C (-22°F to +167°F).

If frequency adjustment is required, refer to one of the procedures below (depending on equipment available) for proper adjustment.

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C416 and L403 on the Oscillator-Multiplier board. The frequency monitored at this point is 9 times the crystal frequency.
2. WITH A COMMUNICATION MONITOR (for example, Coshan Model CE 2). Monitor frequency at the junction of C416 and L403 on the Oscillator-Multiplier board. The frequency monitored at this point is 9 times the crystal frequency. NOTE: This frequency will not always fall within an available measuring range of all monitors at all receiver operating frequencies.

B. STANDARD "ON FREQUENCY" SIGNAL AT THE RECEIVER INPUT (generated from a COMMUNICATION MONITOR, for example: Coshan Model CE-2).

1. WITH A FREQUENCY COUNTER, "Count" the developed IF frequency at the tap of 2602-B3 on the IF-DET board. The deviation from the nominal IF frequency (11.2 MHz) is 2N is compared to the receiver operating frequency (also in MHz) to calculate the frequency error.
2. WITH AN 11.2 MHz IF FREQUENCY STANDARD (for example: General Electric Model 4EX9A10). Loosely couple the IF frequency standard to the IF signal path to create a heterodyne with the developed IF frequency. The resultant "beat frequency" can be monitored by any of the following methods:

NOTE

To set crystal frequency using "beat frequency" methods, the temperature should be at 30°C (86°F). If the temperature is not 30°C, then subtract the "ON FREQUENCY" signal (at the receiver's input), as a function of actual temperature, by the frequency ERROR FACTOR shown in Figure 3.

a. Audible "beat frequency" from the receiver speaker (this requires careful frequency adjustment of the frequency standard).

b. Observe "beat frequency" at J601-1 with an oscilloscope.

c. With GE TEST SET (Meter Position B) connected to J601 on the IF-DET Board, visually observe the "beat frequency" indicated by meter movement.

The frequency of the "beat" is the frequency error related to the IF frequency. This deviation, in Hz, compared to the receiver operating frequency, also in Hz, to calculate the frequency error.

NOTE

The FM Detector output (meter position A of the test set) has a DC voltage of .35 to .50 volts at the assigned frequency and is provided for alignment test and measurement only. The resolution of this reading (approximately .025 V per dB as read on a GE Test Set in meter position A, or 0.1 V per dB as measured with a VTVM at J601-2 on the IF-DET board) is inadequate for oscillator frequency setting.

If the radio is at an ambient temperature of 30°C (86°F) set the oscillator for the correct mixer frequency (crystal FREQ. X 9).

If the radio is not at an ambient temperature of 30°C setting errors can be minimized as follows:

1. Maintain the radio at 30°C (86°F) and set the oscillator to required mixer injection frequency, or
2. Maintain the radio at 30°C (86°C, -10°C) and offset the oscillator, as a function of actual temperature, by the frequency error shown in Figure 3,

For example: Assume the ambient temperature of the radio is 30°C (68°F). At that temperature, the curve shows a correction factor of 670 Hz.

Adjust the oscillator for a corrected mixer injection frequency 670 Hz higher. If a negative correction factor is obtained (at temperatures above 30°C) set the oscillator for the indicated frequency lower than the calculated mixer injection frequency.

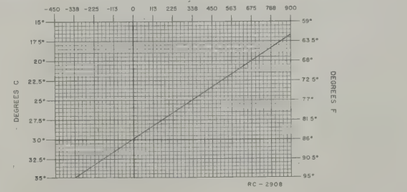


Figure 3 - Crystal Module Frequency Offset Chart

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

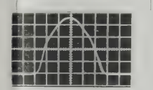
1. GE Test Models 4EX3A11, 4EX8E12 (or 20,000 ohms-per-Volt multimeter with a 1-Volt scale).
2. An 11.2 MHz signal source (GE Test Set Model 4EX9A10). Also a 406-512 MHz signal source (Measurements 803) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. A VTVM.
4. Distortion Analyzer

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to receiver metering jack J601. Set the meter sensitivity switch to the Test 1 (or 1-Volt position on the 4EX8E12).
2. For multi-frequency receivers with a frequency spacing exceeding the above but no greater than 1.60 MHz for frequency range of 406-47 MHz, 1.80 MHz for frequency range of 470-494 MHz, or 1.50 MHz for frequency range of 494-512 MHz, align the receiver using a center frequency tuneup crystal module. These limits can be extended to 2.00 MHz, 2.00 MHz and 2.00 MHz respectively, with 3 dB degradation in standard receiver specifications.
3. With the Test Set in Position G, check for regulated +10 Volts. With multimeter, measure from J601-8(+) and J601-9(-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. Disable the Channel Guard.

ALIGNMENT PROCEDURE

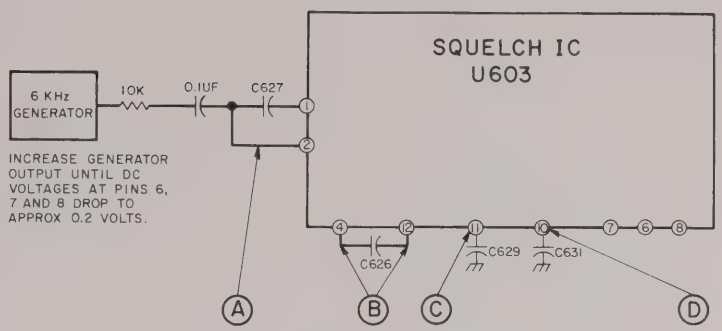
STEP	METERING POSITION GE Test Set	Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			FM DETECTOR		
1.	A (FM DET)	Pin 2	L603	0.38 Volt	With no signal applied, adjust L603 for a meter reading of approximately 0.38 Volt.
			OSCILLATOR-MULTIPLIER		
2.	C (4ELT-3)	Pin 3	C408	Maximum	Tune C408 for maximum meter reading.
3.			C411, C416, C606, C607 and C608	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C606, C607 and C608 fully counterclockwise (minimum capacity).
4.	B (4ELT-3)	Pin 4	C411, C416, C406 and C606	See Procedure	Tune C411 and C416 for maximum meter reading. Retune C411. Next, retune C406, C411 and C416 for maximum meter reading. Then carefully tune C606 for a change in meter reading (peak or dip).
5.	F (4ELT-3)	Pin 7	C606, C607 & C608	See Procedure	Carefully tune C607 and C606 for maximum meter reading. Repeak C607 and C608. Next, carefully tune C608 for minimum meter reading, and retune C606 for maximum meter reading. Do NOT readjust C607 and C608.
			RF SELECTIVITY		
6.	B (IF AMP)	Pin 1	C305, C304 and A303-C2	Maximum	Preset A303-C2 to mid position. Apply an on-frequency signal in the hole adjacent to C306, keeping the signal below saturation. Then tune C305, C304 and then A303-C2 for maximum meter reading.
7.	B (IF AMP)	Pin 1	C304 and C303	Maximum	Apply an on-frequency signal in the hole adjacent to C307, keeping the signal below saturation. Then tune C304 and C303 for maximum meter reading
8.	B (IF AMP)	Pin 1	C303 and C302	Maximum	Apply an on-frequency signal in the hole adjacent to C307, keeping the signal below saturation. Then tune C303 and then C302 for maximum meter reading.
9.	B (IF AMP)	Pin 1	C301 thru C305, A303-C2 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C301 through C305 and A303-C2 for maximum meter reading. In receivers with the UHB preamplifier, also tune L2301 for maximum meter reading.
10.	B (IF AMP)	Pin 1	C301 thru C305, A303-C2 (and L2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305, A303-C2 (and L2301 if present) for best quieting sensitivity.
11.	A	Pin 2	L603, R608	1 Volt RMS	Remove the Test set metering plug from J601. Apply a 100 microvolt signal with 1 kHz modulation at 3.5 kHz deviation to the antenna jack. Tune L603 for maximum voltage (1.0 Volt RMS) and adjust R608 for 1 Volt RMS measured with a VTVM at P903-1 (YLO-5Q #1) and P903-6 (A-).
12.			L507, L503, L504		Connect across signal generator and probe as shown in Figure 2. Set [illegible]
13.			L504	Minimum	Apply a 1000 microvolt signal with 1 kHz m[illegible] position to the antenna jack. Connect a distortion [illegible] (VOM,5Q #1) set monitor the distortion of the [illegible] for minimum distortion.
14.				See Procedure	Check to see that modulation acceptance bandwidth is greater than +7 kHz
15.			R901	36°	SQUELCH ADJUST Set SQUELCH ADJUST control (R901) to open with a 6 dB SINAD signal (approximately 36° counterclockwise of critical squelch position)



STEP 3-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED:

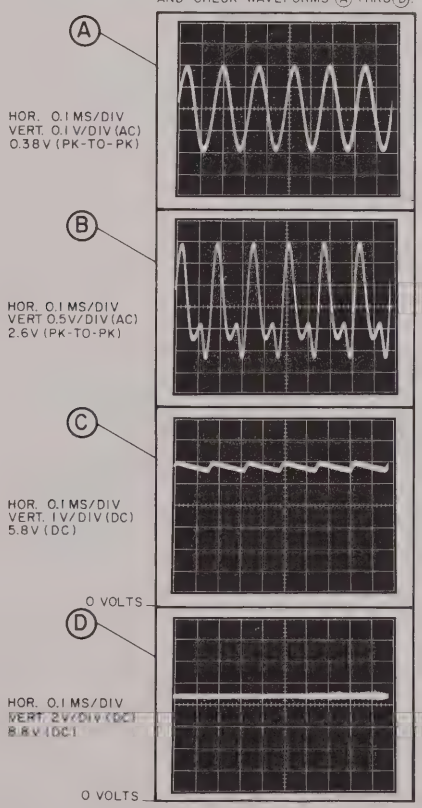
1. OSCILLOSCOPE CONNECTED BETWEEN A- AND POINTS INDICATED BY ARROW.
2. SIGNAL GENERATOR (MEASUREMENTS M803 OR EQUIVALENT.
3. 6 KHz GENERATOR



SQUELCH CIRCUIT CHECKS WITH 6 KHz SIGNAL:

PRELIMINARY STEPS

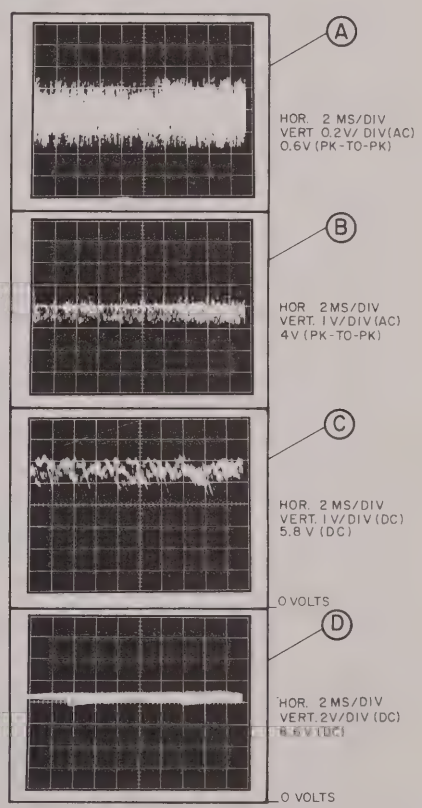
1. QUIET RECEIVER WITH A 1000 MICROVOLT, UNMODULATED SIGNAL.
2. SET SQUELCH CONTROL TO APPROX MID-RANGE.
3. APPLY 6KHz SIGNAL TO PIN 1 AS SHOWN, AND CHECK WAVEFORMS (A) THRU (D).



SQUELCH CIRCUIT CHECK WITH NOISE:

PRELIMINARY STEPS

1. NO INPUT SIGNAL APPLIED
2. SET SQUELCH CONTROL FOR CRITICAL SQUELCH.
3. CHECK WAVEFORMS (A) THRU (D)



RC-2958

TEST PROCEDURES

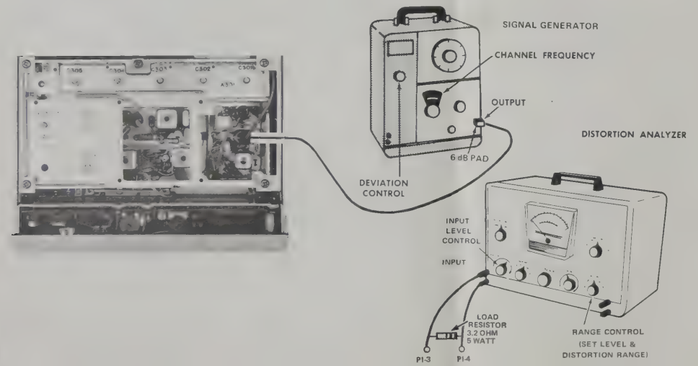
These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:
  Heath IM-12
- Signal Generator similar to:
  Measurements 803
- 6-dB attenuation pad, and 3.2 ohm, 5-Watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1,000-microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.0 kHz deviation to antenna jack A301-J1.

B. With 5-Watt Speaker

Disconnect speaker and connect a 3.2-ohm 5-Watt load resistor from P1-3 (speaker H1) to P1-4 (A-). Connect the Distortion Analyzer input across the resistor as shown.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input across P1-3 and P1-4.

C. Adjust the VOLUME control for 3-Watt output using the Distortion Analyzer as a VTVM (3-1 Vrms).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 5.0 Watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. Audio Gain (Refer to Receiver Troubleshooting Procedure.)

G. FM Detector adjustment (Refer to Receiver Alignment on reverse side of page).

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to A301-J1.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 1.5 Watts (2.2 Volts) RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Reduce the audio output to 0.3 Watts (0.98 VRMS across the 3.2-ohm receiver load.)

C. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

D. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

E. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than ±7 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP 1 - QUICK CHECKS

TEST SET CHECKS

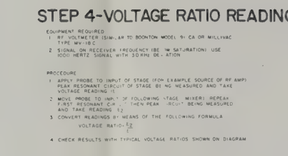
These checks are typical voltage readings measured with GE Test Set Model 4EX3A11 in the Test 1 position, or Model 4EX8E12 in the 1-Volt position.

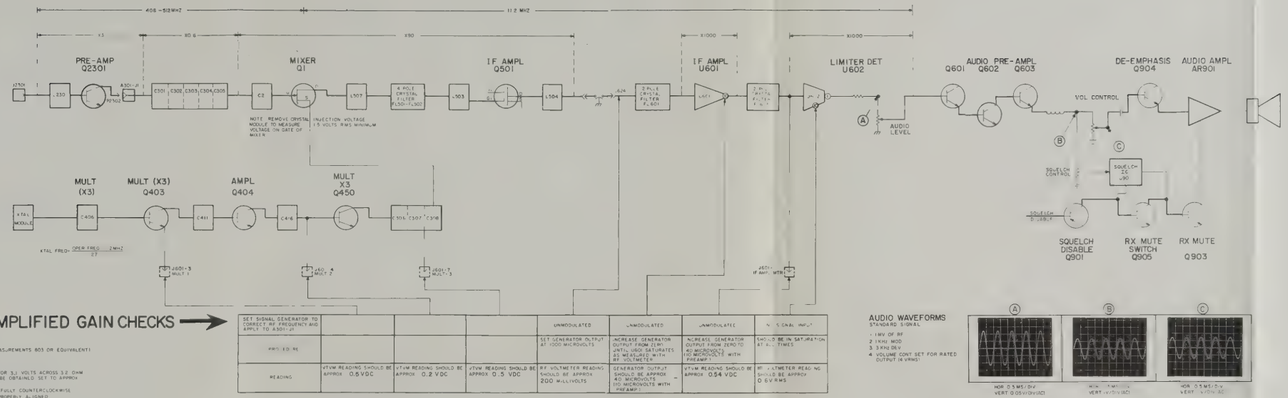
Metering Position	Reading With No Signal In	Reading with 4-Microvolts Unmodulated
A (PW DET)	0.35-0.50 VDC	
B (IF AMP)		0.2 VDC
C (MULT-1)	0.4 VDC	
D (MULT-2)	0.4 VDC	
F (MULT-3)	0.1 VDC	
G (Reg. +10 Volts at J601	+10 VDC	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse in power supply. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-Volt supply. Then check 10-Volt regulator circuit. (See Troubleshooting Procedure for 10-Volt Regulator).
LOW LIM READING	• Check supply voltages and then check oscillator readings at J601 as shown in STEP 2. • Make SIMPLIFIED VTVM GAIN CHECKS from Mixer through 1st Limiter stages as shown in STEP 2.
LOW OSCILLATOR-MULTIPLIER READINGS	• Check alignment of Oscillator-Multiplier chain. (Refer to Front End Alignment Procedure). • Check voltage readings of Oscillator/Multiplier chain (Q407, Q403, Q404).
LOW RECEIVER SENSITIVITY	• Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and antenna switch. • Check Oscillator injection voltage. • Check voltage readings of IF Amplifiers. • Make SIMPLIFIED GAIN CHECKS (STEP 2).
IMPROPER SQUELCH OPERATION	• Check voltages on Schematic Diagram. • Make gain and waveform checks with noise. • Make gain and waveform checks with 6 kHz signal. • Check discrete components in the squelch circuit on SAS board.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver and alignment and FM-DET output. • Check Q601, Q602, Q603 and other discrete components. • Check Q804 and AR901 on SAS board.

STEP 4-VOLTAGE RATIO READING →


EQUIPMENT REQUIRED:
1. RF VOLTMETER (Sim. to BOONTON MODEL 91 CA OR MILLIVAC TYPE MV-18C)
2. SIGNAL GENERATOR FREQUENCY (BE IN SATURATION) USE 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION
PROCEDURE
1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE SOURCE OF RF AMP) PEAK RESONANT CIRCUIT OF STAGE BEING MEASURED AND TAKE VOLTAGE READING (1).
2. MOVE PROBE TO INPUT OF FOLLOWING STAGE (MIXER) REPEAT FIRST RESONANT CIRCUIT (THEN PEAK CIRCUIT BEING MEASURED AND TAKE READING (2).
3. CONVERT READINGS BY MEANS OF THE FOLLOWING FORMULA
VOLTAGE RATIO = 2/1
4. CHECK RESULTS WITH TYPICAL VOLTAGE RATIOS SHOWN ON DIAGRAM



STEP 2-SIMPLIFIED GAIN CHECKS →

EQUIPMENT REQUIRED
1. VTVM, AC & DC
2. SIGNAL GENERATOR (MEASUREMENTS 803 OR EQUIVALENT)
3. RF VOLTMETER

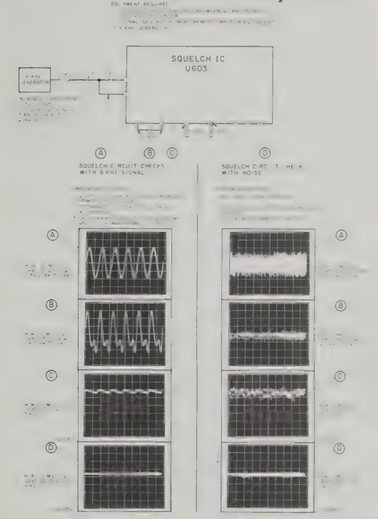
PRELIMINARY STEPS
1. SET VOLUME CONTROL FOR 3.2 VOLTS ACROSS 3.2 OHM LOAD OR TAPE CAPABILITY OBTAINED. SET TO APPROX 50% OF TRAVEL IN CLOCKWISE DIRECTION.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE
3. RECEIVER SHOULD BE PROPERLY ALIGNED
4. CONNECT METER BETWEEN A- AND POINTS INDICATED BY ARROW

SET SIGNAL GENERATOR TO CORRECT RF FREQUENCY AND APPLY TO ANTENNA				UNMODULATED	UNMODULATED	UNMODULATED	UNMODULATED
MEASURE AT:				SET GENERATOR OUTPUT AT 1000 MICROVOLTS	INCREASE GENERATOR OUTPUT FROM ZERO TO 1000 MICROVOLTS AS MEASURED WITH RF VOLTMETER	INCREASE GENERATOR OUTPUT FROM ZERO TO 1000 MICROVOLTS WITH "PREAMP"	SHOULD BE IN SATURATION AT 0.... TIMES
READING	VTVM READING SHOULD BE APPROX 0.6 VDC	VTVM READING SHOULD BE APPROX 0.2 VDC	VTVM READING SHOULD BE APPROX 0.5 VDC	RF VOLTMETER READING SHOULD BE APPROX 200 MILLIVOLTS	GENERATOR OUTPUT SHOULD BE APPROX 40 MICROVOLTS (20 MICROVOLTS WITH "PREAMP")	VTVM READING SHOULD BE APPROX 0.54 VDC	RF VOLTMETER READING SHOULD BE APPROX 0.6 V RMS

AUDIO WAVEFORMS

STANDARD SIGNAL
- 1 MV OF RF
- 1 KHZ MOD
- 3 KHz DEV
- 4 VOLUME CONT SET FOR RATED OUTPUT (4 VRMS)

STEP 3-AUDIO & SQUELCH WAVEFORMS



ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number of component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-1113

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

MOBILE RADIO

MAINTENANCE MANUAL
406—512 MHz RF ASSEMBLY 19D417075G9-G12
AND
IF FILTER BOARD 19C320523G2

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DESCRIPTION

The RF Assembly uses five tuned helical resonators to provide front end RF selectivity with no gain. A UHS pre-amplifier assembly is available that can be used with the receiver to improve sensitivity.

Mixer board A303 uses the RF signal from the RF Assembly and the mixer injection frequency from the oscillator multiplier board to generate the IF frequency.

CIRCUIT ANALYSIS

RF ASSEMBLY

PRE-AMPLIFIER

The pre-amplifier is present only in UHS receivers, and uses a bi-polar transistor to provide approximately 10 dB gain.

RF from the antenna is link-coupled through helical resonator L2301 to the base of Class A pre-amplifier Q2301. L2301 matches the 50-ohm input to the base of Q2301. The amplified output is coupled through L2302, and connected through W2301 to J1 on Antenna Input Board A301. P2301 connects to J502 on the IF-Filter Board for regulated +10-Volt supply voltage.

ANTENNA INPUT A301

An RF signal from the antenna or UHS pre-amplifier is applied to A301 which provides an AC ground between vehicle ground and receiver A-. Resistor R1 prevents a static charge from building up on the vehicle antenna. The output of A301 is coupled through five high Q helical resonators that provide the front end RF selectivity. The helicals are tuned to the incoming frequency by C301 through C305.

MIXER A303

The mixer uses a FET (Q1) as the active device. The FET mixer provides a high input impedance, high power gain, and an output relatively free of harmonics (low in intermodulation products).

In the mixer stage, RF from the helical resonators is coupled through L1 and C2 which matches the RF output to the gate of mixer Q501. Injection voltage from the multiplier-selectivity stages is applied to the source of the mixer. The 11.2 MHz mixer IF output signal is coupled from the drain of Q1 through cable W1 to J501 on the IF Filter board.

IF-FILTER

CRYSTAL FILTER

The output of A303-Q1 is coupled through a tuned circuit (L507 and C515) which matches the output to the input of the four-pole monolithic crystal filter. The highly-selective crystal filter (FL501 and FL502) provides the first portion of the receiver IF selectivity. The output of the filter is coupled through impedance-matching network L503 and C511 to the IF amplifier.

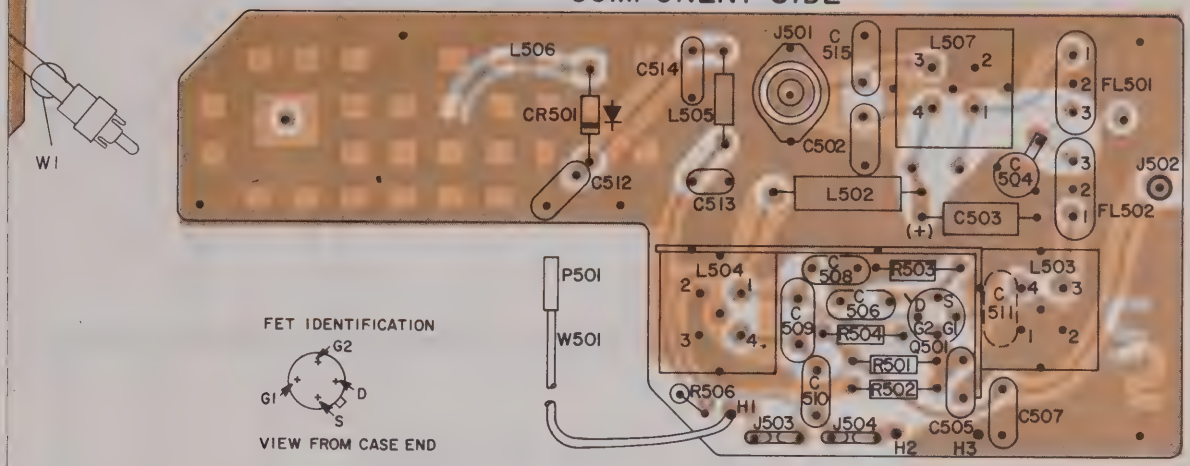
Service Note: Variable capacitor C504 does not require adjustment when performing normal alignment. If the four-pole monolithic crystal filter is replaced, then adjustment of C504 is necessary for optimum IF response.

IF AMPLIFIER

IF Amplifier Q501 is a dual-gate FET. The filter output is applied to Gate 1 of the amplifier, and the output is taken from the drain. The biasing on Gate 2 and the drain load determines the gain of the stage. The amplifier provides approximately 20 dB of IF gain. The output of Q501 is coupled through a network (L504 and C509) that matches the amplifier output to the crystal filter on the IFAS board. The output of the IF-Filter board is applied to the IFAS board through feed-through capacitor C325.

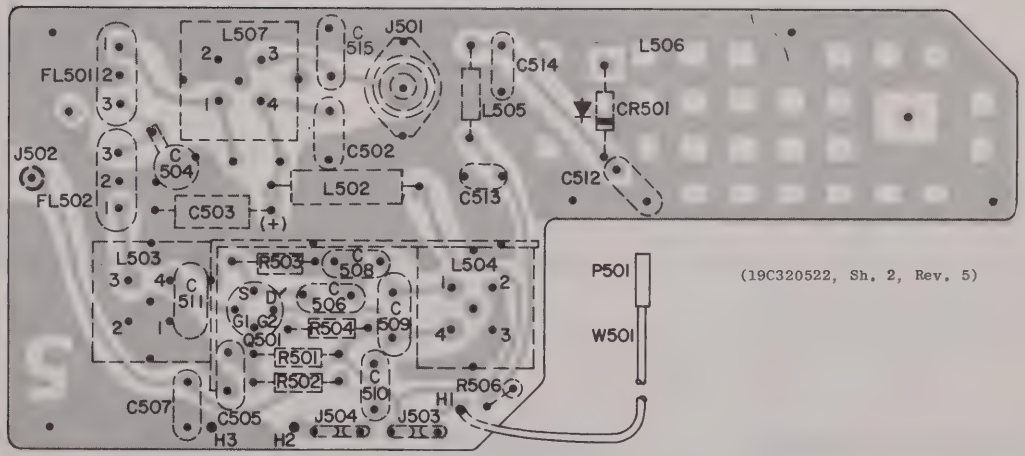
Supply voltage for the RF amplifier and IF-Filter board is supplied from the IFAS board through feed-through capacitor C326.

IF-FILTER BOARD
COMPONENT SIDE



(19C320522, Sh. 2, Rev. 5)
(19C320522, Sh. 3, Rev. 5)

SOLDER SIDE



(19C320522, Sh. 2, Rev. 5)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

406—512 MHz RF ASSEMBLY BOARD
19D417075G9-G12 AND
IF FILTER BOARD 19C320523G2

Service Note: Variable capacitor C504 does not require adjustment when performing normal alignment. If the four-pole monolithic crystal filter is replaced, then adjustment of C504 is necessary for optimum IF response.

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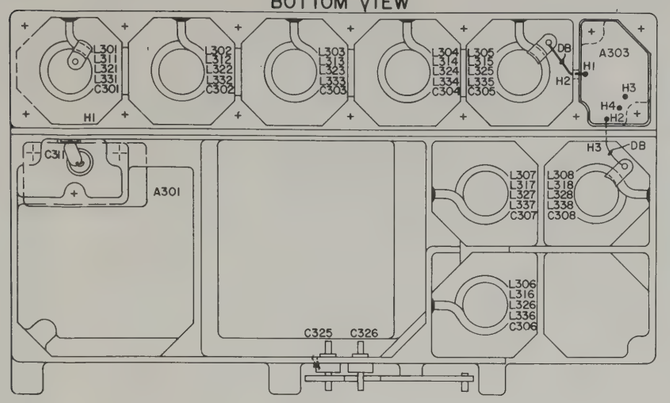
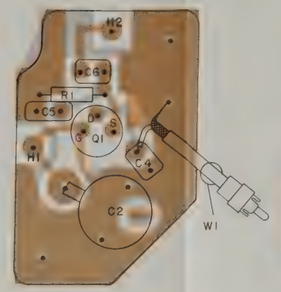
Supply voltage for the RF amplifier and IF-Filter board is supplied from the IFAS board through feed-through capacitor C326.

RF ASSEMBLY BOTTOM VIEW

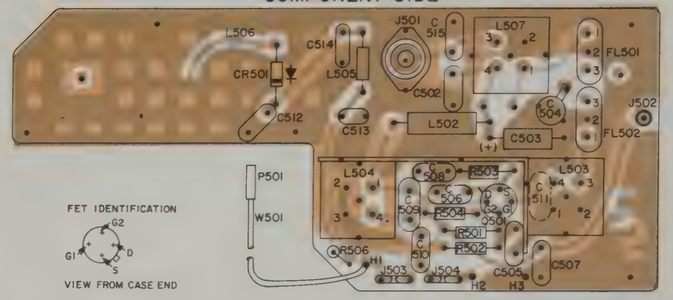


MIXER A304



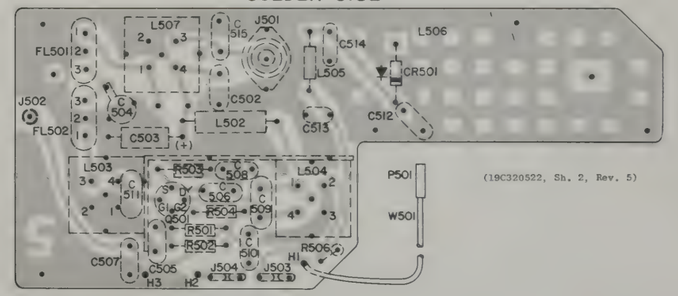
(19D429194, Sh. 2, Rev. 0)
(19D429194, Sh. 3, Rev. 0)

IF-FILTER BOARD COMPONENT SIDE



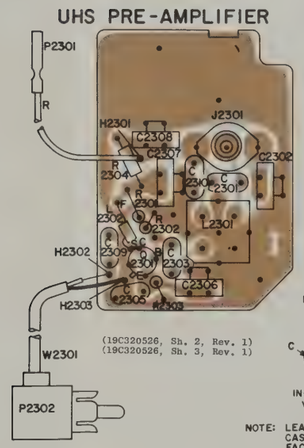
(19C320522, Sh. 2, Rev. 5)
(19C320522, Sh. 3, Rev. 5)

SOLDER SIDE



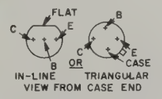
(19C320522, Sh. 2, Rev. 5)

UHS PRE-AMPLIFIER



(19C320526, Sh. 2, Rev. 1)
(19C320526, Sh. 3, Rev. 1)

LEAD IDENTIFICATION FOR Q2301

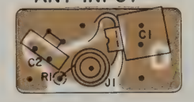


NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION. TAB INDICATES EMITTER LEAD.

LEAD IDENTIFICATION FOR Q1

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION. TAB INDICATES EMITTER LEAD.

A301 ANT INPUT



(19B219941, Sh. 2, Rev. 0)
(19B219941, Sh. 3, Rev. 0)

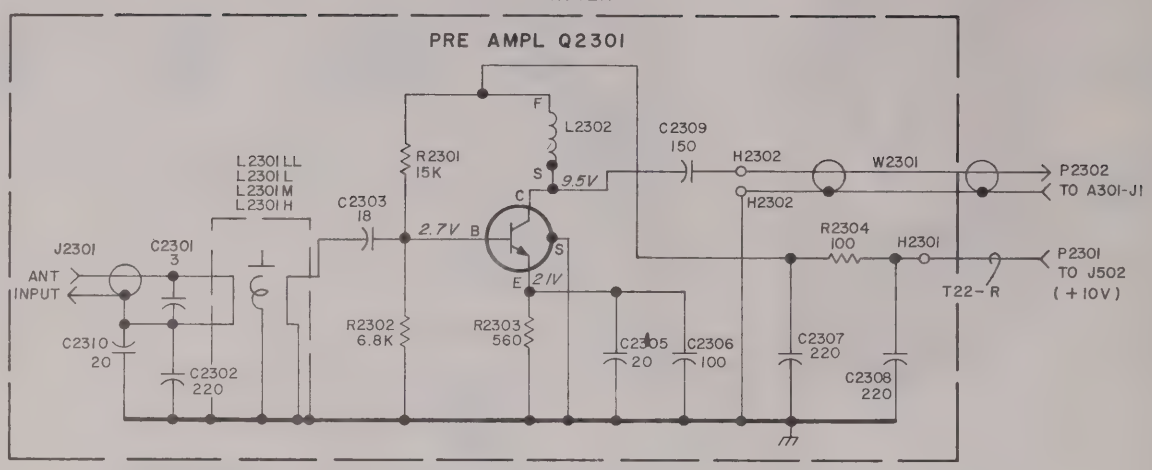
(19D423794, Rev. 2)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

406—512 MHz RF ASSEMBLY BOARD
19D417075G9-G12 AND
IF FILTER BOARD 19C320523G2

UHS PRE – AMPLIFIER

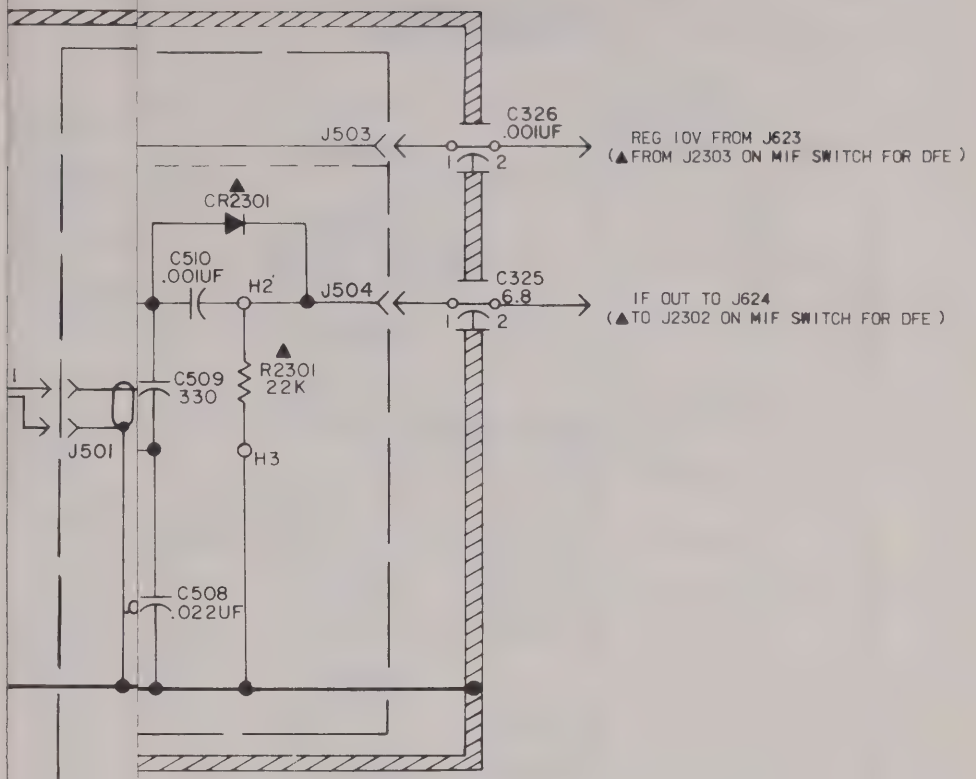


IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

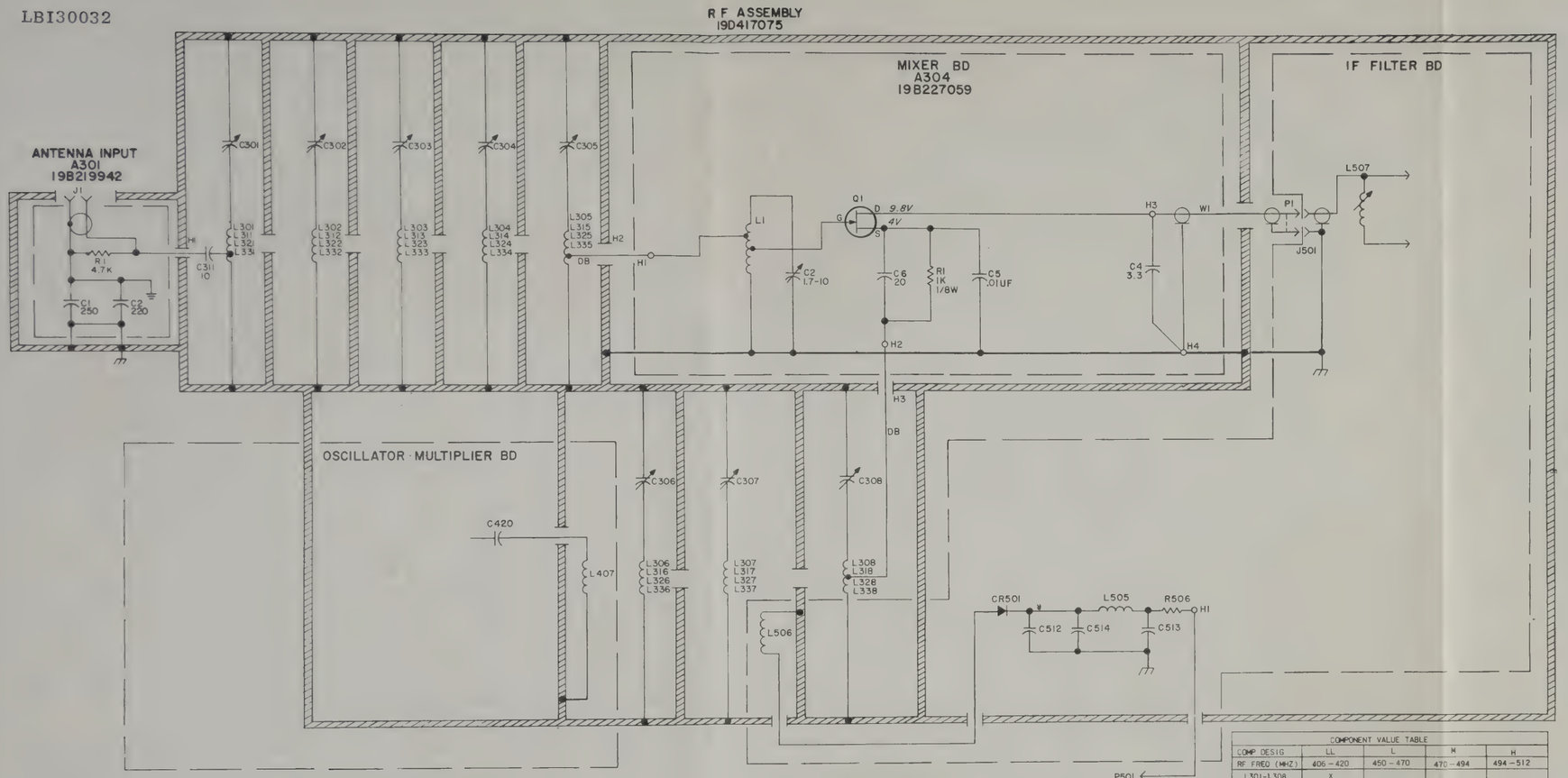
(19B226008, Rev. 3)

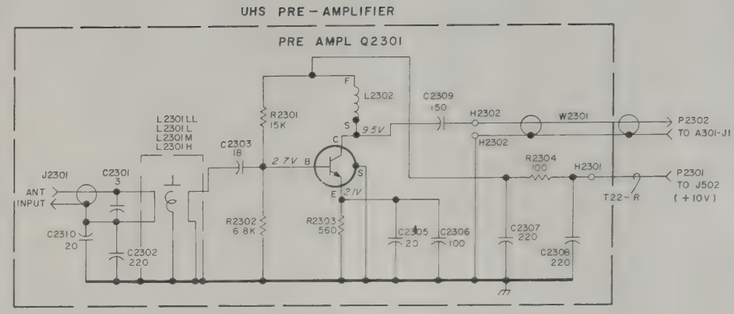
	H
-494	494 – 512
	X



SCHEMATIC DIAGRAM

IF FILTER BOARD 19C320523G2





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IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19B226008, Rev. 3)

COMPONENT VALUE TABLE				
COMP DESIG	LL	L	M	H
RF FREQ (MHZ)	406-420	450-470	470-494	494-512
L301-L308	X			
L311-L318		X		
L321-L328			X	
L331-L338				X

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-10) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

⏚ INDICATES A-

⏚ INDICATES VEHICLE GROUND

	REV LETTER	FREQ RANGE (MHZ)
RF ASSEMBLY		
19D417075G9	B	406-420
19D417075G10	B	450-470
19D417075G11	B	470-494
19D417075G12	B	494-512
MIXER BD		
19B227059G1		
19B227059G2		

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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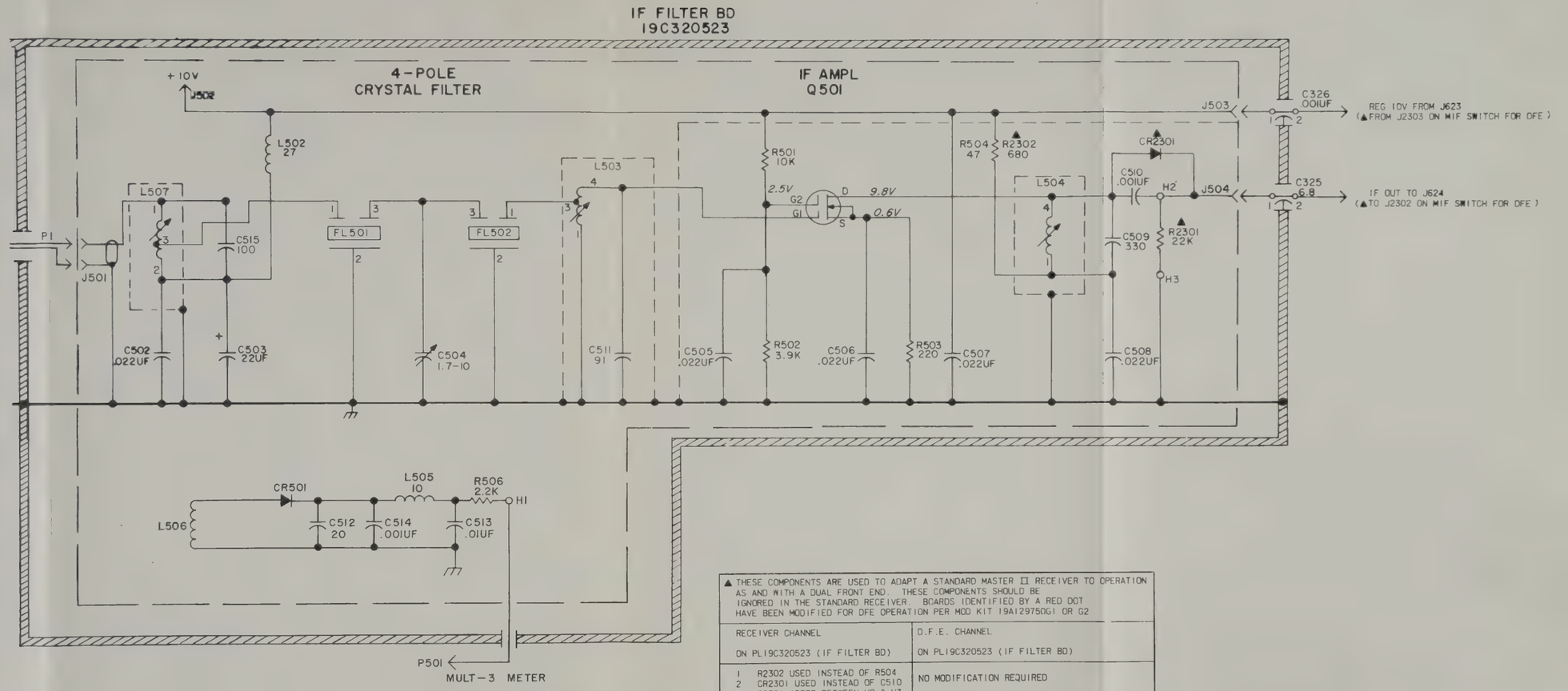
(19D423520, Rev. 4)

SCHEMATIC DIAGRAM

406—512 MHz RF ASSEMBLY BOARD
19D417075G9-G12



▲ THESE COMPONENTS ARE USED TO ADAPT A STANDARD MASTER II RECEIVER TO OPERATION AS AND WITH A DUAL FRONT END. THESE COMPONENTS SHOULD BE IGNORED IN THE STANDARD RECEIVER. BOARDS IDENTIFIED BY A RED DOT HAVE BEEN MODIFIED FOR DFE OPERATION PER MOD KIT 19A129750G1 OR G2	
RECEIVER CHANNEL ON PL19C320523 (IF FILTER BD)	D.F.E. CHANNEL ON PL19C320523 (IF FILTER BD)
1 R2302 USED INSTEAD OF R504 2 CR2301 USED INSTEAD OF C510 3 R2301 ADDED BETWEEN H2 & H3	NO MODIFICATION REQUIRED
	SEE OSC/MULT BD FOR OTHER DFE CHANGES
THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G1	THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G2

	REV LETTER
IF FILTER BD	
19C320523G2	

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-10) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

⏚ INDICATES A-

⏚ INDICATES VEHICLE GROUND

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART

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(19D423519, Rev. 1)

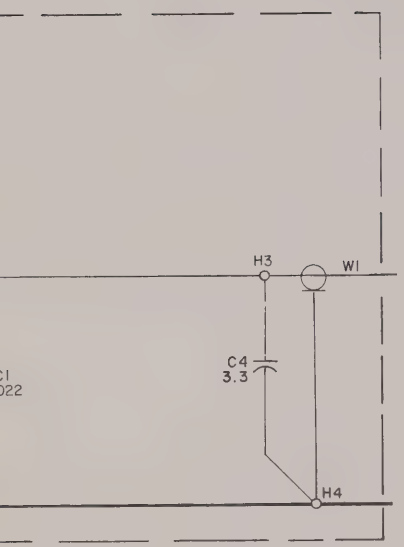
SCHEMATIC DIAGRAM

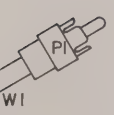
IF FILTER BOARD 19C320523G2

Issue 1

implify circuits
after all the model
ncludes all previous
parts affected by

(19B227059G1)





MOBILE RADIO

DESCRIPTION AND MAINTENANCE
138—174 MHz MASTR CUSTOM MVP RECEIVER

TABLE OF CONTENTS

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- Alignment Procedure ..... Page 3
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DESCRIPTION

MASTR Custom MVP, 138 to 174 megahertz receivers are single conversion, super-heterodyne FM receivers designed for one-through four-frequency operation. The solid state receiver utilizes integrated circuits (ICs), monolithic crystal filters and discrete components with each of the crystal filters located between gain stages to provide 85 dB selectivity and maximum protection from desensitization and intermodulation.

The receiver consists of the following modules:

- RF Assembly
- Mixer-IF (MIF)
- Oscillator-Multiplier (Osc-Mult)
- Audio and Squelch circuits (part of System-Audio & Squelch (SAS) board)
- IF Detector (IF Det)
- Optional Ultra-High Sensitivity (UHS) Pre-Amplifier

Audio, supply voltages and control functions are connected to the system board through P903 on the IF Det board, and through W401 to the Osc-Mult board. The regulated +10 Volts is used for all receiver stages except the audio PA stage which operates from the A+ system supply.

Centralized metering jack J601 on the IF Det board is provided for use with GE Test Set 4EX3A11 or Test Kit 4EX8K12. The test set meters the oscillator, multiplier, FM Detector, 10-Volt regulator, and IF amplifier stages. Speaker high and low may be monitored at J1-3 (Hi) and J1-4 (low).

A block diagram of the complete receiver is shown in Figure 1.

Refer to the appropriate Maintenance Manual for complete details on each receiver module as listed in the Table of Contents.

MAINTENANCE

DISASSEMBLY

To gain access to the receiver for servicing, remove the wing nut at the rear of the radio and pull the radio out of the case assembly.

To remove the RF Assembly and MIF board:

1. Carefully disconnect the two leads connected to loop clips J623 and J624 on the IF Detector board.
2. Unplug receiver input cable P301.
3. Remove the two countersunk flat head screws on each side of the system frame assembly and lift out RF Assembly and MIF board.

To remove the Osc-Mult board:

1. Remove the crystal module.
2. Remove the two screws securing the board.
3. Carefully unplug the Osc-Mult board from the adapter board (on the receiver front end).

To remove the IF Det board:

1. Carefully disconnect the two leads connected to loop clips J623 and J624 on the IF Det board.
2. Disconnect the two plugs (P602 and J903) from the IF Det board.
3. Remove the five screws securing the board and lift the board out.

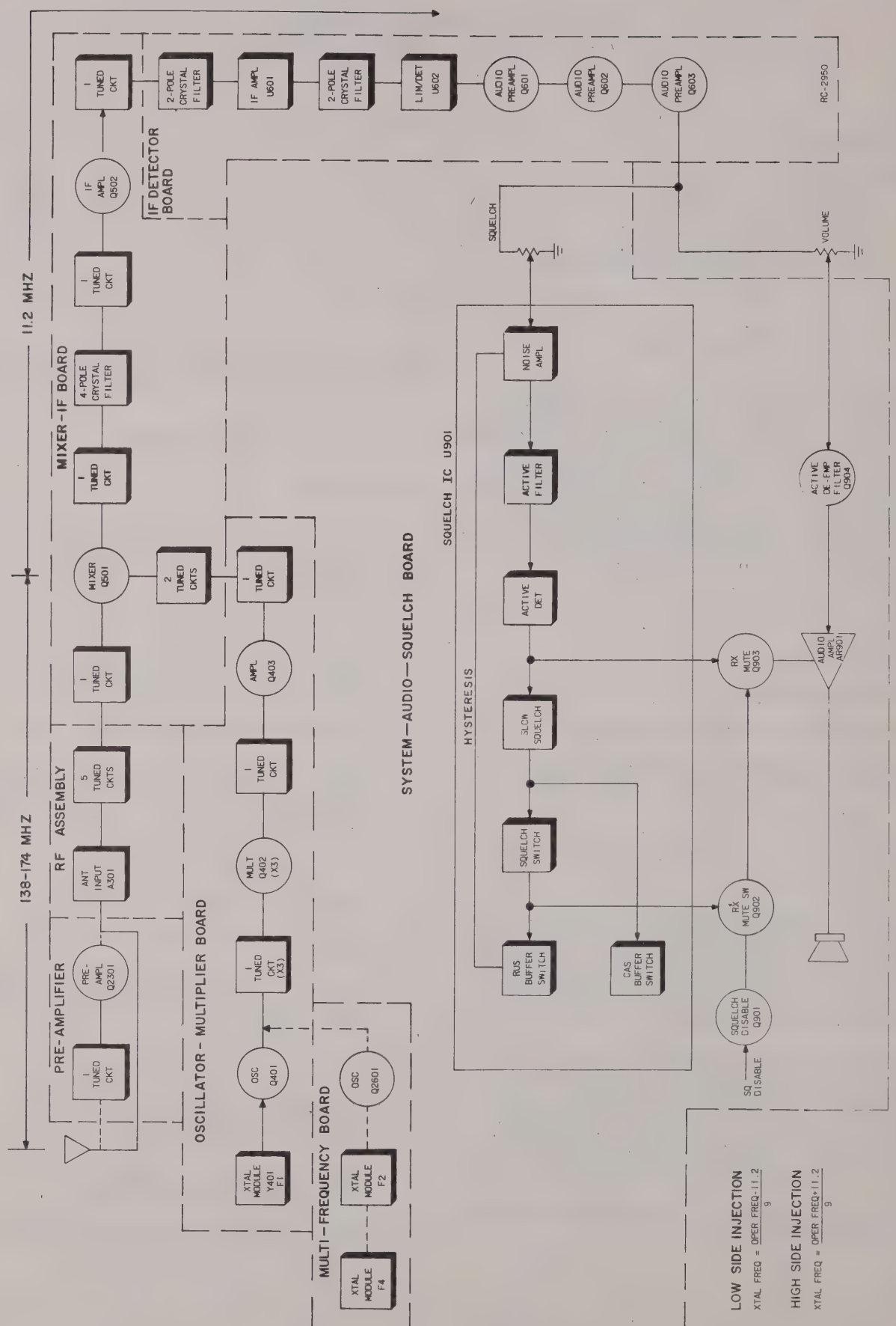


Figure 1 - Receiver Block Diagram

	TUNING CONTROL	METER READING	PROCEDURE
			MIXER & IF
			have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary, d in Step 13.
			NOTE ILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to deter-lignment is required.
	L505, L520, L521 and C521		Connect scope, signal generator, and probe as shown in Figure 2. Set signal generator level for 3 to 5 µV and modulate with 10 kHz at 20 Hz. With probe between J601-1 and A-, tune L505, L520, L521 and C521, for double trace as shown on scope pattern.
		See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7.0 kHz.
			SQUELCH ADJUST
		30°	Set SQUELCH ADJUST control (R901) to open with a 6 dB SINAD signal. (Approximately 30° counterclockwise of critical squelch position).

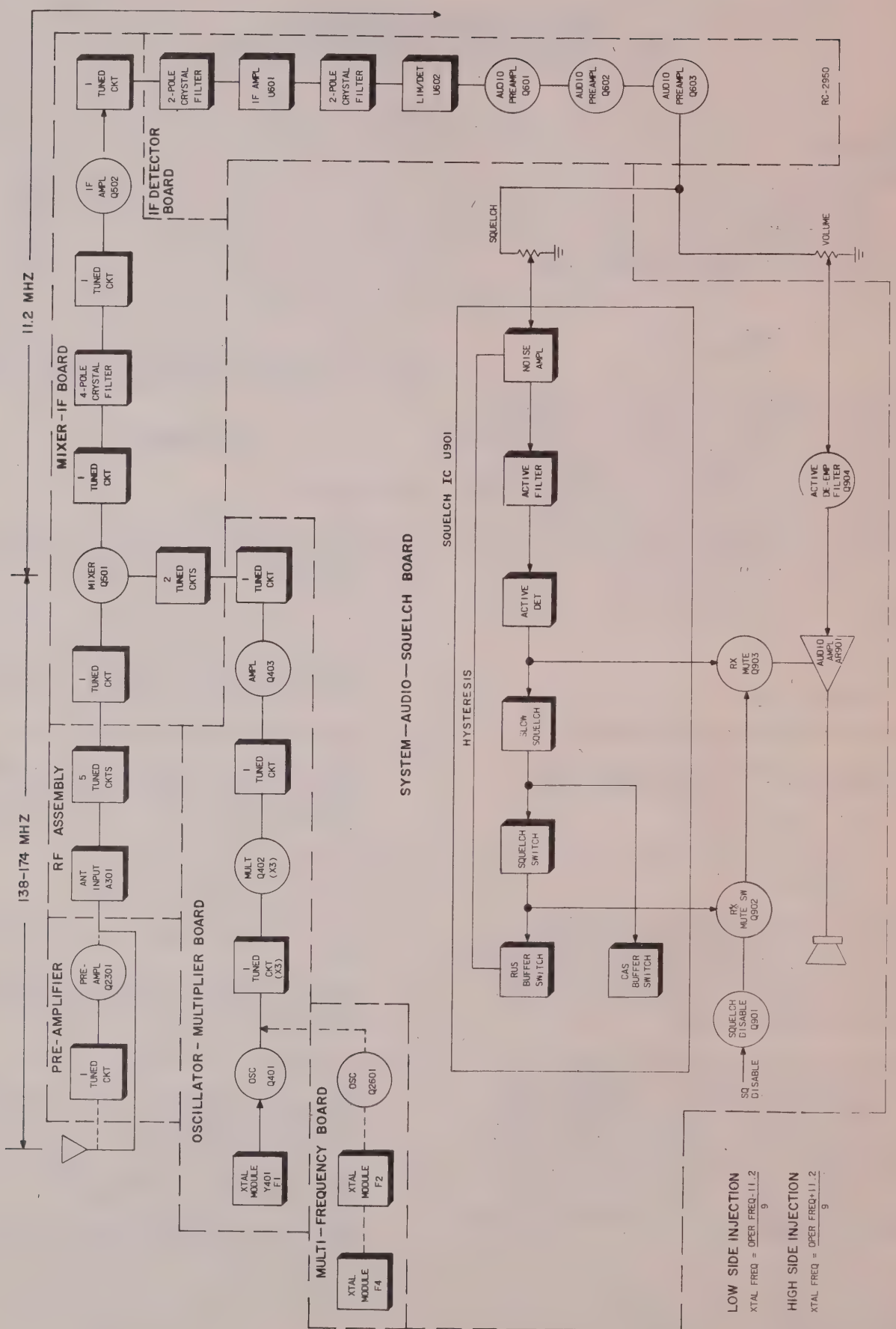


Figure 1 - Receiver Block Diagram

FRONT END ALIGNMENT

EQUIPMENT

1. GE Test Set Models 4EX3A11, 4EX8K12 or 20,000 ohms-per-Volt multimeter with a 1-Volt scale.
2. A 138-174 MHz signal source.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect black plug from Test Set to Receiver Centralized Metering Jack J601. Set range selector switch to the TEST 1 position (or 1-Volt position on 4EX8K10).
2. For multi-frequency receivers with a frequency spacing up to 0.450 MHz for frequency range of 138-155 MHz, or 0.500 MHz for frequency range of 150.8-174 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than .900 MHz for frequency range of 138-155 MHz, or 1.00 MHz for frequency range of 150.8-174 MHz, align the receiver using a center frequency tune-up crystal module. These limits can be extended to 1.60 MHz and 1.80 MHz respectively with 3 dB degradation in standard receiver specifications.
3. With Test Set in Position G, check for regulated +10 Volts. If using multimeter, measure between J601-6 (+) and J601-9 (-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. Disable Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			OSCILLATOR-MULTIPLIER		
1.	C (MULT-1)	Pin 3	C406	Maximum	Tune C406 for maximum meter reading.
2.			C411, C416, C306, C307	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C306 and C307 fully counterclockwise (minimum capacity).
3.	D (MULT-2)	Pin 4	C411, C416, C406	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading, then, carefully dip C306 and tune C307 for maximum meter reading. Do NOT readjust C306 and C307.
			RF SELECTIVITY		
4.	B (IF AMP)	Pin 1	C502, C301 thru C305 (and T2301 if present)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C502 and C501 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune T2301 for maximum meter reading.
5.	B (IF AMP)	Pin 1	C502, C301 thru C305 (and T2301 if present) C306 & C307	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305 and C502 (and T2301 if present) for best quieting sensitivity. C306 and C307 may also be tuned slightly (not exceeding 1/4 turn).

NOTE 1: Appendix A of DATAFILE Bulletin 1000-6 contains instructions for building a sweep modulator.

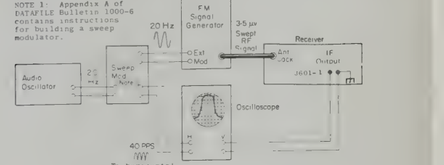
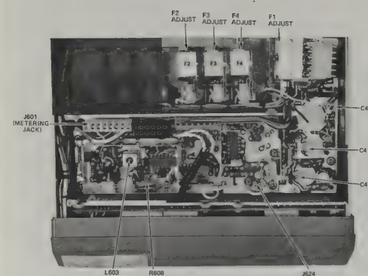
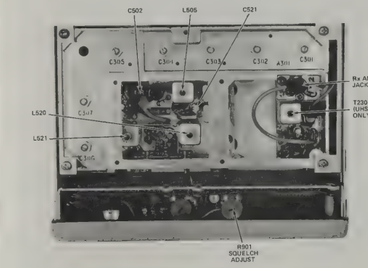


Figure 2 - Test Setup for 20-Hz Double-Trace Sweep Alignment





OSCILLATOR FREQUENCY ADJUSTMENT

First check the frequency to determine if any adjustment is required. (Refer to frequency adjust chart, Figure 3.) The frequency measurement requires equipment with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained. When adjusting the frequency, the entire radio should be as near as possible to an ambient temperature of 30°C (86°F).

The frequency of the crystal module should only be reset when the measured frequency error exceeds the following limits:

A. ±0.2 PPM when the ambient temperature of the radio is 30°C (86°F).

B. ±5 PPM at any other temperature within the range of -30°C to +75°C (-22°F to +167°F).

If frequency adjustment is required, refer to one of the procedures below (depending on equipment available) for proper adjustment.

A. DIRECT MEASUREMENT IN THE INJECTION CHAIN

1. WITH A FREQUENCY COUNTER. "Count" the frequency at the junction of C416 and L403 on the Oscillator-Multiplier board. The frequency measured at this point is 9 times the crystal frequency.
2. WITH A COMMUNICATION MONITOR (for example: Cushman Model CE-3). "Monitor" frequency at the junction of C416 and L403 on the Oscillator-Multiplier board. The frequency monitored at this point is 9 times the crystal frequency. NOTE: This frequency will not always fall within an available measuring range of all monitors at all receiver operating frequencies.

B. STANDARD "RF FREQUENCY" SIGNAL AT THE RECEIVER INPUT (Generated from a COMMUNICATION MONITOR, for example: Cushman Model CE-3).

1. WITH A FREQUENCY COUNTER. "Count" the developed IF frequency at the tap of R608-R2 on the IF-DET board. The deviation from the nominal IF frequency (11.8 MHz) in Hz is computed to the receiver operating frequency (also in Hz) to calculate the frequency error.
2. WITH AN 11.8 MHz IF FREQUENCY STANDARD (for example: General Electric Model 4EX8A10). Loosely couple the IF frequency standard to the IF signal path to create a heterodyne with the developed IF frequency. The resultant "beat frequency" can be monitored by any of the following methods:

NOTE

To set crystal frequency using "beat frequency" method, the temperature should be at 30°C (86°F). If the temperature is not 30°C, then offset the "ON FREQUENCY" signal (at the receivers input), as a function of actual temperature, by the frequency ERROR FACTOR shown in Figure 3.

a. Audible "beat frequency" on J601-1 with an oscilloscope.

b. Observe "beat frequency" at J601-1 with an oscilloscope.

c. With GE TEST SET (Meter Position E) connected to J601 on the IF-DET Board, visually observe the "beat frequency" indicated by meter movement.

The frequency of the "beat" is the frequency error related to the IF frequency. This deviation, in Hz, is compared to the receiver operating frequency, also in Hz, to calculate the frequency error.

NOTE

The FM Detector output (meter position A of the test set) has a DC voltage of .35 to .50 volts at the assigned frequency and is provided for routine test and measurement only. The resolution of this reading (approximately .005 V per Hz as read on a GE Test Set in meter Position A, or 0.1 V per kHz as measured with a VTVM at J601-6 on the IF-DET board) is inadequate for oscillator frequency setting.

If the radio is at an ambient temperature of 30°C (86°F) set the oscillator for the correct mixer frequency (crystal FREQ. "F").

If the radio is not at an ambient temperature of 30°C setting errors can be minimized as follows:

A. To hold setting error to ±0.2 PPM (which is considered reasonable for 0 PPM oscillators):

1. Maintain the radio at 30°C (86°F) and set the oscillator to required mixer injection frequency, or

2. Maintain the radio at 30°C (85°C, -10°F) and offset the oscillator, as a function of actual temperature, by the frequency error shown in Figure 3.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 225 Hz.

Adjust the oscillator for a corrected mixer injection frequency 225 Hz higher. If a negative correction factor is obtained (at temperatures above 30°C), set the oscillator for the indicated frequency lower than the calculated mixer injection frequency.

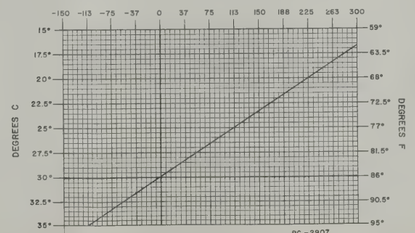


Figure 3 - Frequency Characteristics Vs. Temperature

COMPLETE RECEIVER ALIGNMENT

EQUIPMENT REQUIRED

1. GE Test Set Models 4EX3A11, 4EX8K12 or 20,000 ohms-per-Volt multimeter with a 1-Volt scale.
2. An 11.2 MHz signal source (GE Test Set Model 4EX9A10). Also a 138-174 MHz signal source (Measurements 805) with a one-inch piece of insulated wire no larger than .065 inch diameter connected to generator probe.
3. A VTVM.
4. Distortion Analyzer.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Connect the black plug from the Test Set to receiver metering jack J601. Set the range selector switch to the Test 1 (or 1-Volt position on the 4EX8K10).
2. For multi-frequency receivers with a frequency spacing up to 0.450 MHz for frequency range of 138-155 MHz, or 0.500 MHz for frequency range of 150.8-174 MHz, align the receiver on the channel nearest center frequency.

   For multi-frequency receivers with a frequency spacing exceeding the above but no greater than .900 MHz for frequency range of 138-155 MHz or 1.00 MHz for frequency range of 150.8-174 MHz, align the receiver using a center frequency tune-up crystal module. These limits can be extended to 1.60 MHz and 1.80 MHz respectively with 3 dB degradation in standard receiver specifications.
3. With the Test Set in Position G, check for regulated +10 Volts. If using multimeter, measure from J601-6 (+) to J601-9 (-).
4. If using multimeter, connect the negative lead to J601-9 (A-).
5. Disable the Channel Guard.

ALIGNMENT PROCEDURE

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			FM DETECTOR		
1.	A (FM DET)	Pin 2	L603	0.38 Volt	With no signal applied, adjust L603 for a meter reading of approximately 0.38 Volt.
			OSCILLATOR-MULTIPLIER		
2.	C (MULT-1)	Pin 3	C406	Maximum	Tune C406 for maximum meter reading.
3.			C411, C416, C306, C307	See Procedure	Preset C411 and C416 to a position similar to C406. Next, preset C306 and C307 fully counterclockwise (minimum capacity).
4.	D (MULT-2)	Pin 4	C411, C416, C406	See Procedure	Tune C411 and C416 for maximum meter reading. Next, retune C406, C411 and C416 for maximum meter reading, then, carefully dip C306 and tune C307 for maximum meter reading. Do NOT readjust C306 and C307.
			RF SELECTIVITY		
5.	B (IF AMP)	Pin 1	C503	Maximum	Apply an on-frequency signal in the hole adjacent to C305 and tune C503 for maximum meter reading.
6.	B (IF AMP)	Pin 1	C305	Maximum	Apply an on-frequency signal in the hole adjacent to C304, keeping the signal below saturation. Then tune C305 for maximum meter reading
7.	B (IF AMP)	Pin 1	C304	Maximum	Apply an on-frequency signal in the hole adjacent to C303, keeping the signal below saturation. Then tune C304 for maximum meter reading.
8.	B (IF AMP)	Pin 1	C303	Maximum	Apply an on-frequency signal in the hole adjacent to C302, keeping the signal below saturation. Then tune C303 for maximum meter reading
9.	B (IF AMP)	Pin 1	C302 and C301	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C302 and C301 for maximum meter reading.
10.	B (IF AMP)	Pin 1	C502, C301 thru C305 (and T2301 if preset)	Maximum	Apply an on-frequency signal to the antenna jack, keeping the signal below saturation. Then tune C502 and C501 through C305 for maximum meter reading. In receivers with the UHS preamplifier, also tune T2301 for maximum meter reading.
11.	B (IF AMP)	Pin 1	C502, C301 thru C305 (and T2301 if present) C306 & C307	Maximum	Apply an on-frequency signal to the antenna jack and slightly tune C301 through C305 and C502 (and T2301 if present) for best quieting sensitivity. C306 and C307 may also be tuned slightly (not exceeding 1/4 turn
12.	A (FM DET)	Pin 2	L603 R608	1 Volt RMS	Remove the Test Set metering plug from J601. Apply a 1000 microvolt signal with 1 kHz modulation and 3.0 kHz deviation to the antenna jack. Tune L603 for maximum voltage at 1 kHz and adjust R608 for 1 Volt RMS measured with a VTVM at P903-1 (VOL/SQ #1) and P903-6 (A-).

ALIGNMENT PROCEDURE

STEP	METERING POSITION GE Test Set	METERING POSITION Multimeter - at J601-9	TUNING CONTROL	METER READING	PROCEDURE
			MIXER & IF		
			The mixer and IF circuits have been aligned at the factory and will normally require no further adjustment. If adjustment is necessary use the procedure outlined in Step 13.		
			NOTE Refer to DATAFILE BULLETIN 1000-6 (IF Alignment of Two-Way Radio FM Receivers) for helpful suggestions on how to determine when IF Alignment is required.		
13.			L505, L520, L521 and C521		Connect scope, signal generator, and probe as shown in Figure 3. Set signal generator level for 3 to 5 μV and modulate with 10 kHz at 20 Hz. Set scope sweep, sync, gain, horiz. gain and pos. and vert. gain and pos. for pattern shown on scope pattern.
14.				See Procedure	Check to see that modulation acceptance bandwidth is greater than ±7.0 kHz
			SQUELCH ADJUST		
15.				30°	Set SQUELCH ADJUST control (R901) to open with a 6 dB SINAD signal (approximately 30° counterclockwise of critical squelch position).

TEST PROCEDURES

These Test Procedures are designed to help you to service a receiver that is operating---but not properly. The problems encountered could be low power, poor sensitivity, distortion, limiter not operating properly, and low gain. By following the sequence of test steps starting with Step 1, the defect can be quickly localized. Once the defective stage is pin-pointed, refer to the "Service Check" listed to correct the problem. Additional corrective measures are included in the Troubleshooting Procedure. Before starting with the Receiver Test Procedures, be sure the receiver is tuned and aligned to the proper operating frequency.

TEST EQUIPMENT REQUIRED

- Distortion Analyzer similar to:

  Heath IM-12

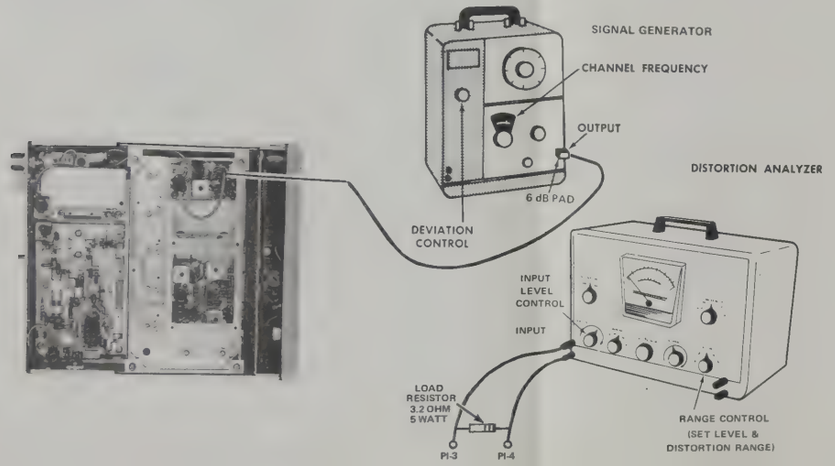
- Signal Generator similar to:

  Measurements 803

- 6-dB attenuation pad, and 3.2-ohm, 5-watt resistor

PRELIMINARY ADJUSTMENTS

1. Connect the test equipment as shown for all steps of the receiver Test Procedure.
2. Turn the SQUELCH control fully clockwise for all steps of the Test Procedure.
3. Turn on all of the equipment and let it warm up for 20 minutes.



STEP 1
AUDIO POWER OUTPUT AND DISTORTION

TEST PROCEDURE

Measure Audio Power Output as follows:

A. Apply a 1,000-microvolt, on-frequency test signal modulated by 1,000 hertz with ±3.0 kHz deviation to antenna jack A301-J1.

B. With 5-Watt Speaker:

Disconnect speaker and connect a 3.2-ohm, 5-Watt load resistor from P1-3 (Speaker Hi) to P1-4. Connect the Distortion Analyzer input across the resistor as shown.

OR

With Handset:

Lift the handset off of the hookswitch. Connect the Distortion Analyzer input to P1-3 and P1-4.

C. Adjust the VOLUME control for 3-Watt output using the Distortion Analyzer as a VTVM (3.1 VTMS).

D. Make distortion measurements according to manufacturer's instructions. Reading should be less than 5%. If the receiver sensitivity is to be measured, leave all controls and equipment as they are.

SERVICE CHECK

If the distortion is more than 5%, or maximum audio output is less than 5-Watts, make the following checks:

E. Battery and regulator voltage---low voltage will cause distortion. (Refer to Receiver Schematic Diagram for voltages.)

F. Audio Gain (Refer to Receiver Troubleshooting Procedure.)

G. FM Detector Adjustment (Refer to Receiver Alignment on reverse side of page).

STEP 2
USABLE SENSITIVITY (12-dB SINAD)

If STEP 1 checks out properly, measure the receiver sensitivity as follows:

A. Apply a 1000-microvolt, on-frequency signal modulated by 1000 Hz with 3.0-kHz deviation to A301-J1.

B. Place the RANGE switch on the Distortion Analyzer in the 200 to 2000-Hz distortion range position (1000-Hz filter in the circuit). Tune the filter for minimum reading or null on the lowest possible scale (100%, 30%, etc.)

C. Place the RANGE switch to the SET LEVEL position (filter out of the circuit) and adjust the input LEVEL control for a +2 dB reading on a mid range (30%).

D. While reducing the signal generator output, switch the RANGE control from SET LEVEL to the distortion range until a 12-dB difference (+2 dB to -10 dB) is obtained between the SET LEVEL and distortion range positions (filter out and filter in).

E. The 12-dB difference (Signal plus Noise and Distortion to noise plus distortion ratio) is the "usable" sensitivity level. The sensitivity should be less than rated 12 dB SINAD specifications with an audio output of at least 1.5 Watts (2.2 Volts RMS across the 3.2-ohm receiver load using the Distortion Analyzer as a VTVM).

F. Leave all controls as they are and all equipment connected if the Modulation Acceptance Bandwidth test is to be performed.

SERVICE CHECK

If the sensitivity level is more than rated 12 dB SINAD, check the alignment of the RF stages as directed in the Alignment Procedure, and make the gain measurements as shown on the Troubleshooting Procedure.

STEP 3
MODULATION ACCEPTANCE BANDWIDTH (IF BANDWIDTH)

If STEPS 1 and 2 check out properly, measure the bandwidth as follows:

A. Set the Signal Generator output for twice the microvolt reading obtained in the 12-dB SINAD measurement.

B. Reduce the audio output to 0.3 watts (0.98V RMS) across the 3.2 ohm receiver load.

C. Set the RANGE control on the Distortion Analyzer in the SET LEVEL position (1000-Hz filter out of the circuit), and adjust the input LEVEL control for a +2 dB reading on the 30% range.

D. While increasing the deviation of the Signal Generator, switch the RANGE control from SET LEVEL to distortion range until a 12-dB difference is obtained between the SET LEVEL and distortion range readings (from +2 dB to -10 dB).

E. The deviation control reading for the 12-dB difference is the Modulation Acceptance Bandwidth of the receiver. It should be more than 7.0 kHz.

SERVICE CHECK

If the Modulation Acceptance Bandwidth test does not indicate the proper width, make gain measurements as shown on the Receiver Troubleshooting Procedure.

STEP I - QUICK CHECKS

TEST SET CHECKS

These checks are typical voltage readings measured with GE Test Set Model 4EX3A11 in the Test 1 position, or Model 4EX8K12 in the 1-Volt position.

Metering Position	Reading With No Signal In	Reading with 1 Microvolt Unmodulated
A (FM DET)	0.35 to 0.50 VDC	
B (IF Amp)		0.2 VDC
C (Mult=1)	0.45 VDC	
D (Mult-2)	0.1 VDC	
G (Reg. +10 Volts at J601	+10 VDC	

SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply leads, and check fuse. If fuse is blown, check receiver for short circuits.
NO REGULATED 10-VOLTS	• Check the 12-Volt supply. Then check 10-Volt regulator circuit. (See Troubleshooting Procedure for 10-Volt Regulator).
LOW LIM READING	• Check supply voltages and then check oscillator readings at J601-3 & 4 as shown in STEP 2. • Make SIMPLIFIED VTVM GAIN CHECKS from Mixer through 1st Limiter stages as shown in STEP 2.
LOW OSCILLATOR/MULTIPLIER READINGS	• Check alignment of Oscillator/Multiplier. (Refer to Front End Alignment Procedure). • Check voltage readings of Oscillator/Multiplier (Q402, Q403, Q404).
LOW RECEIVER SENSITIVITY	• Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and antenna switch. • Check Oscillator injection voltage. • Check voltage readings of Mixer and IF Amp. • Make SIMPLIFIED GAIN CHECKS (STEP 2).
IMPROPER SQUELCH OPERATION	• Check voltages on Schematic Diagram. • Make gain and waveform checks with noise. • Make gain and waveform checks with 6 kHz signal. • Check discrete components in the squelch circuit.
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks. • Check receiver and alignment and FM Detector output. • Check Q601, Q602 and Q603 and other discrete components. • Check AR901 on SAS board.

RC-2959

STEP 4-VOLTAGE RATIO READINGS

EQUIPMENT REQUIRED

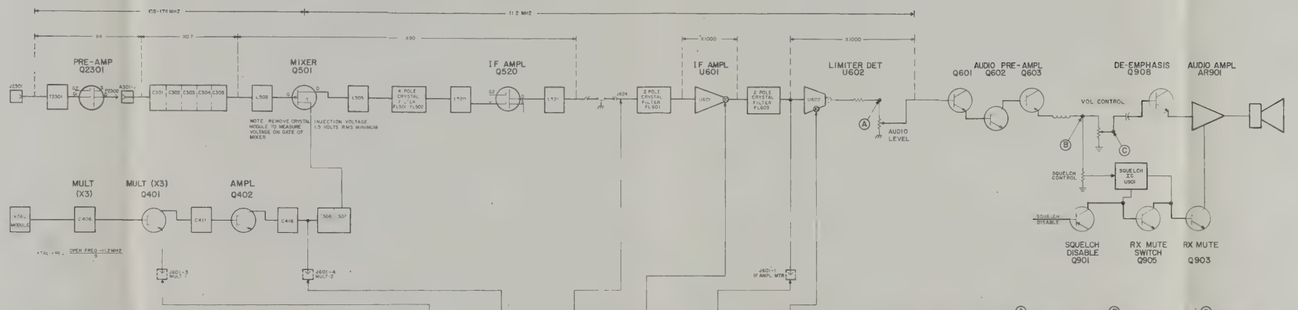
1. RF SIGNAL GENERATOR (SIMILAR TO BOONTON MODEL 91-CA OR MILLIVAC MODEL MV-47)
2. SIGNAL ON RECEIVER FREQUENCY (BELOW SATURATION) USE 1000 HERTZ SIGNAL WITH 3.0 KHz DEVIATION

PROCEDURE

1. APPLY PROBE TO INPUT OF STAGE (FOR EXAMPLE SOURCE OF RF AMP) [illegible] VOLTAGE BEING MEASURED AND TAKE [illegible] READING.
2. [illegible] CIRCUIT BEING MEASURED [illegible] VOLTAGE RATIO [illegible].
3. CONVERT READINGS BY MEANS OF THE FOLLOWING FORMULA

   VOLTAGE RATIO = $\frac{\text{A}}{\text{B}}$

4. CHECK RESULTS WITH TYPICAL VOLTAGE RATIOS SHOWN ON DIAGRAM



STEP 2-SIMPLIFIED GAIN CHECKS

EQUIPMENT REQUIRED

1. [illegible] GENERATOR TO CORRECT RF FREQUENCY AND APPLY 75 KHz DEV.
2. SIGNAL GENERATOR (MEASUREMENTS 805 OR EQUIVALENT
3. RF VOLTMETER

PRELIMINARY STEPS

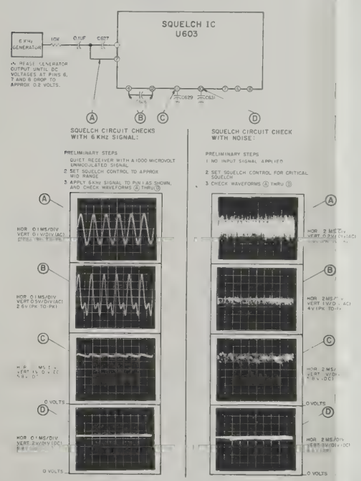
1. [illegible] VOLUME CONTROL FOR 1.5 VOLTS ACROSS 4-7 OHM LOAD. IF THIS CANNOT BE OBTAINED, SET TO APPROX. 1/2 OF MAX. ROTATION.
2. SET SQUELCH CONTROL FULLY COUNTERCLOCKWISE
3. RECEIVER SHOULD BE PROPERLY ALIGNED
4. CONNECT METER BETWEEN A+ AND POINTS INDICATED BY ARROW

METER GENERATOR TO CORRECT RF FREQUENCY AND APPLY 75 KHz DEV.			UNMODULATED	UNMODULATED	UNMODULATED	NO SIGNAL INPUT
PROCEDURE			SET GENERATOR OUTPUT AT 1000 MICROVOLTS	INCREASE GENERATOR OUTPUT FROM ZERO AS NEEDED TO OBTAIN 20 MICROVOLTS AT VOLTMETER	INCREASE GENERATOR OUTPUT FROM ZERO TO 10 MICROVOLTS (WITH PREAMP)	SHOULD BE IN SATURATION AT ALL TIMES
READING			RF VOLTMETER READ AS APPROX. 0.5 VDC	RF VOLTMETER READ AS APPROX. 0.2 VDC	RF VOLTMETER READ AS APPROX. 200 MILLIVOLTS	RF VOLTMETER READ AS SHOULD BE APPROX. 0.54 VDC	RF VOLTMETER READ AS SHOULD BE APPROX. 0.6 V RMS

STEP 3-AUDIO & SQUELCH WAVEFORMS

EQUIPMENT REQUIRED

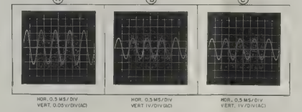
1. OSCILLOSCOPE CONNECTED BETWEEN A+ AND POINTS INDICATED BY ARROW
2. SIGNAL GENERATOR (MEASUREMENTS 805 OR EQUIVALENT
3. RMS VOLTMETER



AUDIO WAVEFORMS

STANDARD SIGNAL

1. MIC OFF
2. 1 KHz MOD
3. 3 KHz DEV
4. VOLUME CONT SET FOR RATED OUTPUT IN VRMS)



STEP 1 - QUICK CHECKS

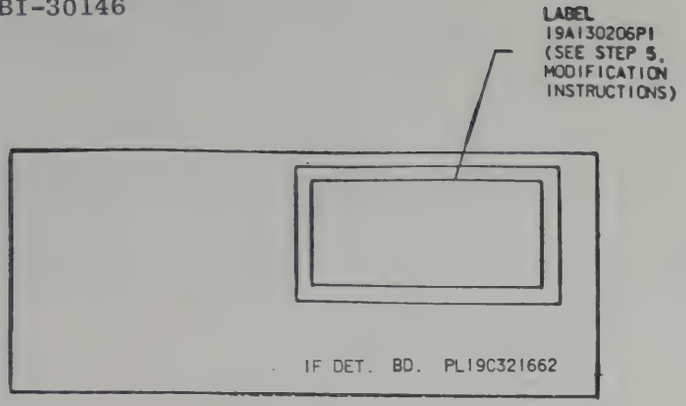
TEST SET CHECKS

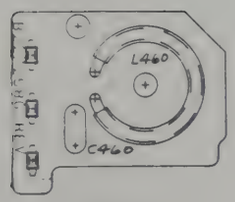
These checks are typical voltage readings measured with CE Test Set Model 4EX31A1 in the Test 1 position, or Model 4EX88A1 in the 3-volt position.

Metering Position	Reading With No Signal In	Reading with 1 Microvolt Unmodulated
A (FM DET)	0.35 to 0.50 VDC	
B (IF Amp)		0.2 VDC
C (Mult=1)	0.45 VDC	
D (Mult=3)	0.1 VDC	
G (Reg. +10 Volts at J601	+3 VDC	

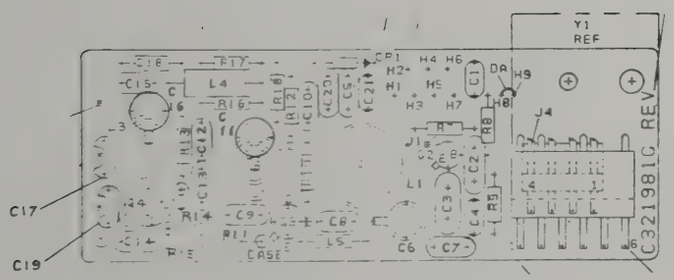
SYMPTOM CHECKS

SYMPTOM	PROCEDURE
NO SUPPLY VOLTAGE	• Check power connections and continuity of supply lead and check fuse. If fuse is blown, check receiver for short circuits
NO REGULATED 10-VOLTS	• Check the 12-Volt supply. Then check 10-Volt regulator circuit. (See Troubleshooting Procedure for Regulator).
LOW LIM READING	• Check supply voltages and then check oscillator readings at J601-3 & 4 as shown in STEP 2 • Make SIMPLIFIED VTVM GAIN CHECKS from Mixer thru Limiter stages as shown in STEP 2
LOW OSCILLATOR/MULTIPLIER READINGS	• Check alignment of Oscillator Multiplier. (Refer to Receiver End Alignment Procedure). • Check voltage readings of Oscillator/Multiplier (Q400 Q402, Q404)
LOW RECEIVER SENSITIVITY	• Check Front End Alignment. (Refer to Receiver Alignment Procedure). • Check antenna connections, cable and antenna switch • Check Oscillator injection voltage • Check voltage readings (Mixer and IF Amp • Make SIMPLIFIED GAIN CHECKS (STEP 2)
IMPROPER SQUELCH OPERATION	• Check voltages on Schematic Diagram • Make gain and waveform checks with noise. • Make gain and waveform checks with 6 KHz signal. • Check discrete components in the squelch circuit
LOW OR DISTORTED AUDIO	• Check voltages on Schematic Diagram. • Make gain and waveform checks • Check receiver and alignment and FM Detector output • Check Q601, Q602 and Q603 and other discrete components • Check AR901 on SAS board

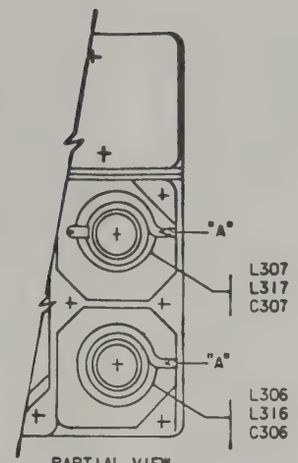




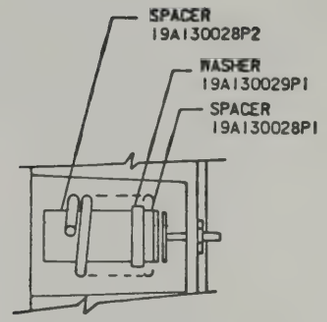
ADAPTER BD
19B227258



OSC/MULT BD 19C321981



PARTIAL VIEW
R.F. CKT PL19D416693



VIEW AT "A"
(PARTIAL)
(TYP TWO PLACES)

(4) MODIFICATION INSTRUCTIONS FOR HIGH BAND HIGH SIDE INJECTION APPLYING 19A130045G1 OR G2 KIT

1. ON OSC/MULT. BD. 19C321981G5 (LOW SPLIT) REMOVE C12 & C17 REPLACE C7 WITH C2311 (12pf, NPO), REPLACE C19 WITH C2312 (3pf, NPO). REPLACE C460 (ON 19B227258) WITH C2313 (5pf, NPO). DISCARD C2314.
   ON OSC/MULT. BD. 19C321981G6 (HIGH SPLIT), REMOVE C7 & C12. REPLACE C460 (ON 19B227258) WITH C2314 (4pf, NPO).
   DISCARD C2311 AND C2313.
   SOLDER ALL ELECTRICAL CONNECTIONS. C2301 THRU C2314 ARE PART OF MOD KIT 19A130045G1, C2311 THRU C2314 ONLY—G2.
2. MODIFY RF. CKT ASM PL19D416693 BY ADDING 19A130028P1 SPACER, 19A130029P1 WASHER, AND 19A130028P2 SPACER AS SHOWN TO L306 & L307 (LOW SPLIT) OR L316, & L317 (HIGH SPLIT). SLIDE SPACERS, & WASHER ON CERAMIC POST FROM TOP IN ORDER SHOWN. THESE ITEMS ARE PART OF MOD KIT PL19A130045G1 AND G2.
3. IN APPLICATION OF THIS KIT THE CRYSTAL OSCILLATOR FREQUENCY MUST BE CHANGED PER THE FOLLOWING FORMULA:
$$Fx = \frac{Fo + 11.2}{9}$$
4. MARK ALL OSC/MULT. BD'S 19C321981 WITH A BLUE COLOR DOT IN THE AREA OF THE PL DRAWING NO. PER 19A115740P1.
   MARK ALL RECEIVER CASTINGS WITH A BLUE COLOR DOT IN THE AREA OF THE PL DRAWING NO. PER 19A115740P1.
5. APPLY LABEL (19A130206P1) TO DETECTOR COVER ON IF DET BD.
6. TEST AND ALIGN PER NORMAL PROCEDURE WITH THE FOLLOWING EXCEPTION: PRE-ADJUST C11 AND C16 TO MINIMUM CAPACITY, THEN TUNE IN SLOWLY.

(19C320883, Sh. 4, Rev. 2)

HIGH SIDE INJECTION MODIFICATION

138—174 MHz MASTR CUSTOM MVP RECEIVER

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service Parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number of component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-1113

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

MAINTENANCE MANUAL

138—174 MHz RF ASSEMBLY 19D416693G1, G2 AND MIXER/IF/NOISE BLANKER BOARD 19D416662G1

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PARTS LIST & PRODUCTION CHANGES ..... Page 8

DESCRIPTION

The RF Assembly uses five tuned helical resonators to provide front end RF selectivity. A preamplifier is standard in receivers with a noise blanker.

The Mixer/IF/Noise Blanker board (MIF/NB) uses the RF input from the RF Assembly and the mixer injection frequency from the oscillator multiplier board to generate the IF frequency. The noise blanker eliminates undesirable noise interference in the received audio.

CIRCUIT ANALYSIS

RF ASSEMBLY

RF PRE-AMPLIFIER

RF from the antenna is applied to antenna jack J551 on the MIF/NB board. The signal is transformer coupled through T551 to Gate 1 of preamplifier Q553, which is a dual-gate Field Effect Transistor (FET) and provides approximately 8 dB of gain. The primary of T551 provides a 50-ohm input impedance. The amplified output signal at the Drain terminal of Q553 is coupled through T552 to J1 on the Antenna Input board (A301) through cable W551. T552 is tapped to provide a 50-ohm output impedance.

ANTENNA INPUT A301

An RF signal from the receiver Preamplifier (Q553) is applied to A301 which provides an AC ground between vehicle ground and receiver A-. Resistor R1 prevents a static charge build up on the vehicle antenna. The output of A301 is coupled through five "high Q" helical resonators that provide front end RF selectivity. The helicals are tuned to the incoming frequency by C301 through C305.

MIXER/IF/NOISE BLANKER

MIXER & CRYSTAL FILTER

The mixer uses a FET (Q501) as the active device. The FET mixer provides a high input impedance, high power gain, and an output relatively free of harmonics (low in intermodulation products).

In the mixer stage, RF from the RF amplifier stage is coupled through L502/C502 which matches the RF output to the gate of mixer Q501. Injection voltage from the multiplier-selectivity stages is applied to the source of the mixer. The mixer IF output signal is coupled from the drain of Q501 through a tuned circuit (L503 and C505) to the first FET noise blanker gate Q502. The IF signal is then coupled through a tuned circuit (L505 and C517) to the second FET noise blanker gate Q503.

During the presence of impulse noise from the antenna, the noise blanker circuit (IC-U551) provides a positive pulse to the gates of Q502 and Q503 which attenuates the IF signal during the noise pulse period (see noise blanker description for details). This eliminates undesirable noise interference in the received audio without degrading receiver performance.

The mixer IF output signal is then coupled to the input of the four-pole monolithic crystal filter. The highly selective crystal filter (FL501 and FL502) provides the first portion of the receiver IF selectivity. The output of the crystal filter is coupled through impedance-matching network L520 and C522 to the IF Amplifier (Q520).

Service Note: Variable capacitor C521 does not require adjustment when performing normal alignment. If the four-pole monolithic crystal filter is replaced, then adjustment of C521 is necessary for optimum IF response.

IF AMPLIFIER

IF amplifier Q520 is a dual-gate FET. The crystal filter output is applied to Gate 1 of the amplifier, and the output is taken from the drain. The biasing on Gate 2 and the drain lead determines the gain of the stage. The amplifier provides approximately 20 dB of IF gain. The output of Q520 is coupled through a network (L521 and C528) that matches the amplifier output to the following stage. The output is coupled through C325 to the next IF stage, or to the MIF switch in Dual Front End applications.

Supply voltage for the RF amplifier and MIF/NB board is supplied through feedthrough capacitor C326.

NOISE BLANKER

An RF signal and noise pulse from the antenna (J551) is fed simultaneously to the Noise Blanker 1st RF Amplifier and the RF Assembly (A302). The signal and noise is transformer coupled through L551 of T551 to the 1st RF amplifier Q551 (dual-gate FET). The input signal is applied to Gate 1 of the amplifier, and the output is taken from the drain. The biasing of Gate 2 and the drain load determines the gain of the stage. The signal is then coupled through tuned circuits L552/C558 and L553/C560 to the 2nd RF applifier, Q552, which is also a dual-gate FET. The combined gain of Q551 and Q552 is approximately 35 dB.

The amplified signal is coupled through tuned circuit L554/C564 to pulse detector/amplifier/switch IC (U551). IC (U551) is a custom hybrid integrated circuit which contains a pulse detector, pulse amplifier, pulse amplifier/switch, intermodulation detector and a blanker disable switch. The IC functions as a pulse detector and processing circuit for the noise blanker. Regulated 10 VDC, which powers U551, is applied through pin 3. The associated capacitors (C571, C572 and C574) provide emitter decoupling for various stages of the IC.

Pulse Detector

The impulse noise from the RF amplifier is applied to pin 6 of U551 through tuned circuit L554/C564 to the pulse detector. Bias for the detector is established by R563, R564 and CR551. Diode CR551 is normally conducting, thus biasing the pulse detector. A positive pulse applied to the pulse detector causes it to conduct heavily. The output of the detector is a negative going pulse that is relatively free of any RF components. The pulse detector metering point (BLANKER METER) connects from pin 2 of U551 to connector J601-pin 7 and serves as a convenient measuring point when performing alignment.

Pulse Amplifier and Noise Blanker Disable Switch

The negative pulse output from the pulse detector turns the pulse amplifier ON, producing a positive output pulse. The threshold point of the pulse amplifier and the RF gain of the 1st and 2nd RF amplifier stages (Q551 and Q552) in the noise blanker circuit prevent noise blanking due to any low-level inherent receiver noise.

An optional noise blanker disable switch is available for manually disabling the noise blanker circuits. Connecting pin 4 of U551 to A- turns the disable switch ON, which in turn inhibits the pulse amplifier.

Pulse Amplifier/Switch

The positive output pulse from the pulse amplifier is fed to the pulse amplifier/switch. This circuit functions as a constant width pulse generator whose output is a positive 6 Volt pulse with a duration of 2 microseconds. This pulse is applied from pin 11 of U551 to the noise blanker gates (Q502 and Q503). Noise blanker gates Q502 and Q503 are turned ON (conducting) during the presence of the noise blanking pulse. These gates present a low impedance RF path to A- for the pulse duration (approximately 3 microseconds), providing approximately 60 dB attenuation of the IF signal and the impulse noise present. As the noise signal from the antenna is applied to the noise blanker circuits, the RF signal is also applied to the receiver RF input. The inherent delay presented to the received RF signal and the impulse noise by the helical resonators in the receiver RF assembly (L301/L311 through L305/L315) allows the noise blanking pulse to turn ON the blanking

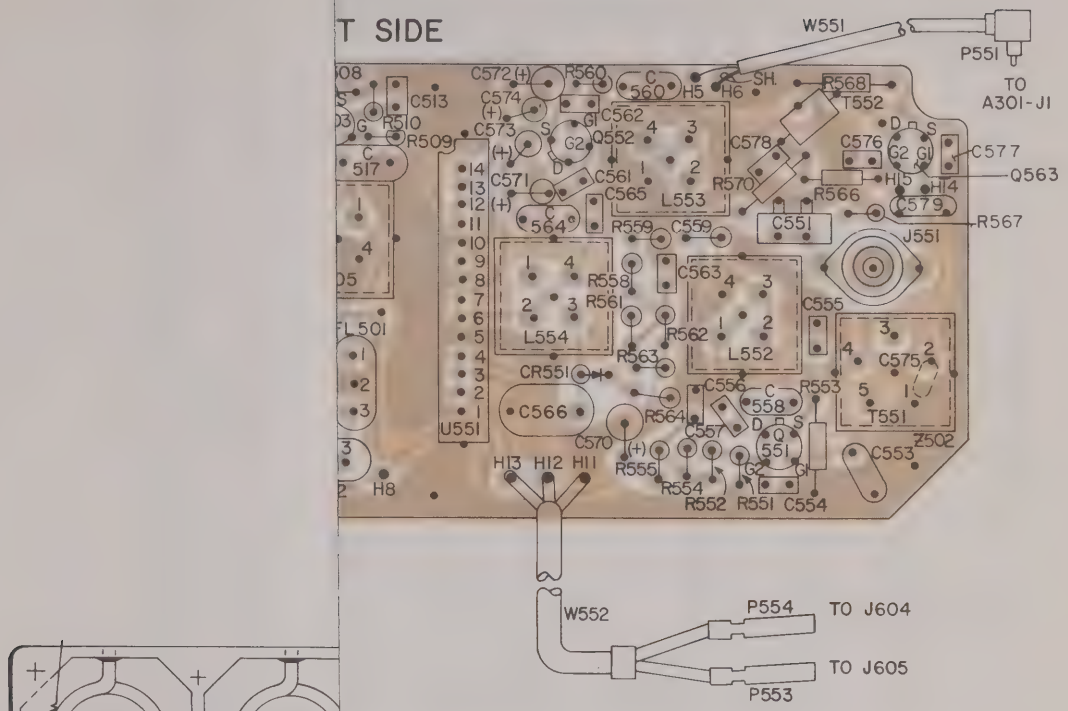
gates, attenuating the received signal just prior to the arrival of the impulse noise.

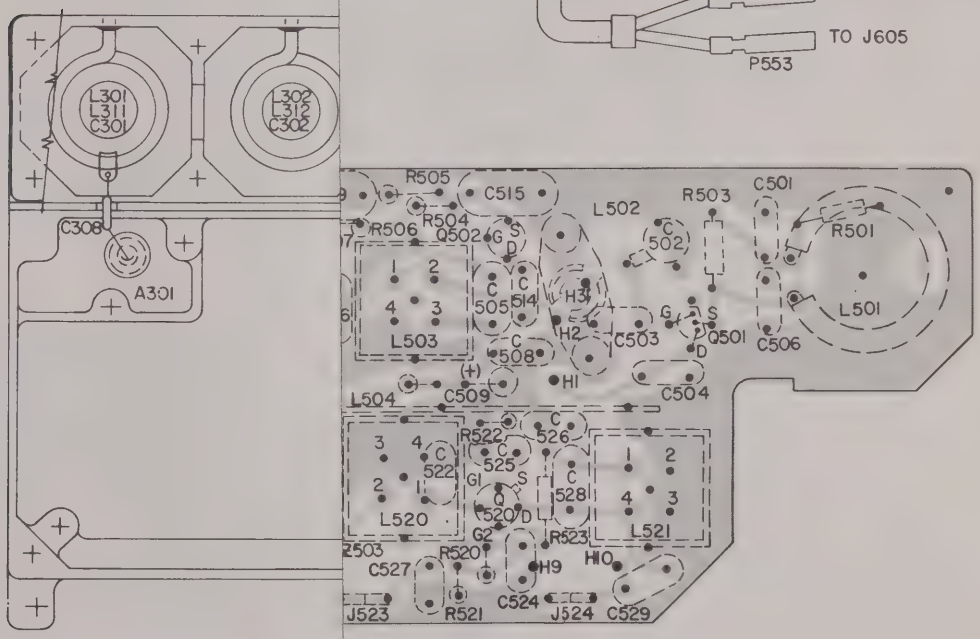
Intermodulation (IM) Detector

The output of the pulse amplifier is also applied to the IM detector. The IM detector does not respond to noise pulses appearing at its input because of the circuit design utilized, but the detector is activated during the presence of a sinusoidal signal. This sinusoidal signal is the beat frequency difference of two signals present in the noise blanker channel. A resultant AGC voltage (approximately +3 VDC) is developed through the integrating action of C573 and is applied from pin 13 of U551 to the 2nd RF amplifier (Q552) of the noise blanker circuit. This action sufficiently reduces the gain of the noise blanker RF stage (Q552) so that receiver performance is not degraded by blanking pulses which would create receiver intermodulation close to the receiver operating frequency.

LANKER BOARD

T SIDE





1, Sh. 2, Rev. 0)

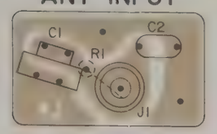
553 Q502 & Q503

CASE END

OUTLINE DIAGRAM

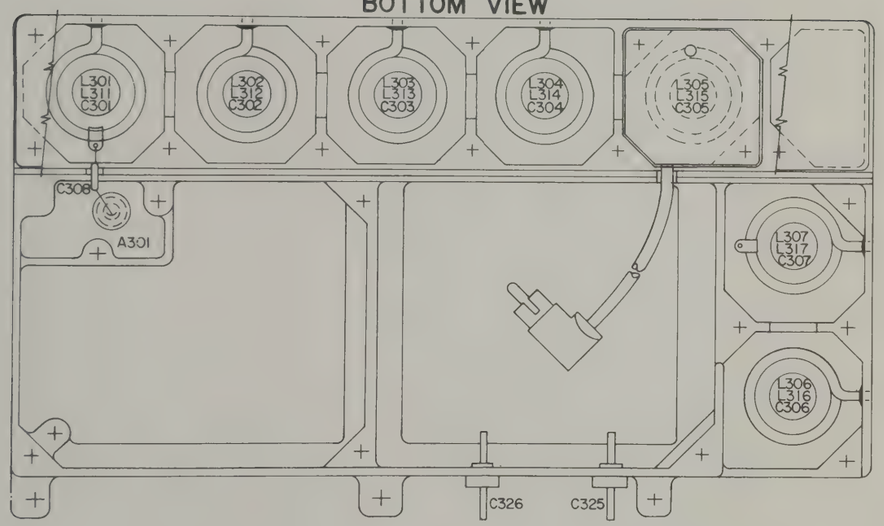
138—174 MHz RF ASSEMBLY AND MIXER/IF/NOISE BLANKER

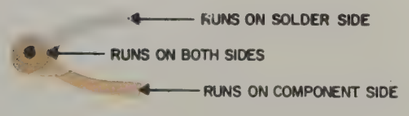
A301
ANT INPUT



(19B219679, Sh. 2, Rev. 2)
(19B219679, Sh. 3, Rev. 2)

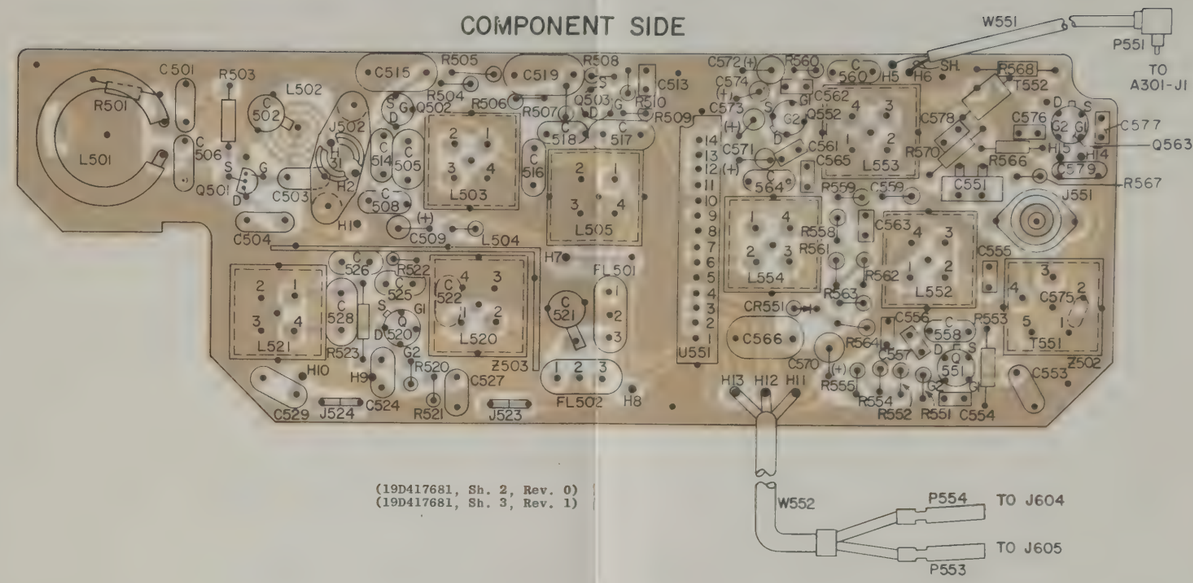
RF ASSEMBLY
BOTTOM VIEW





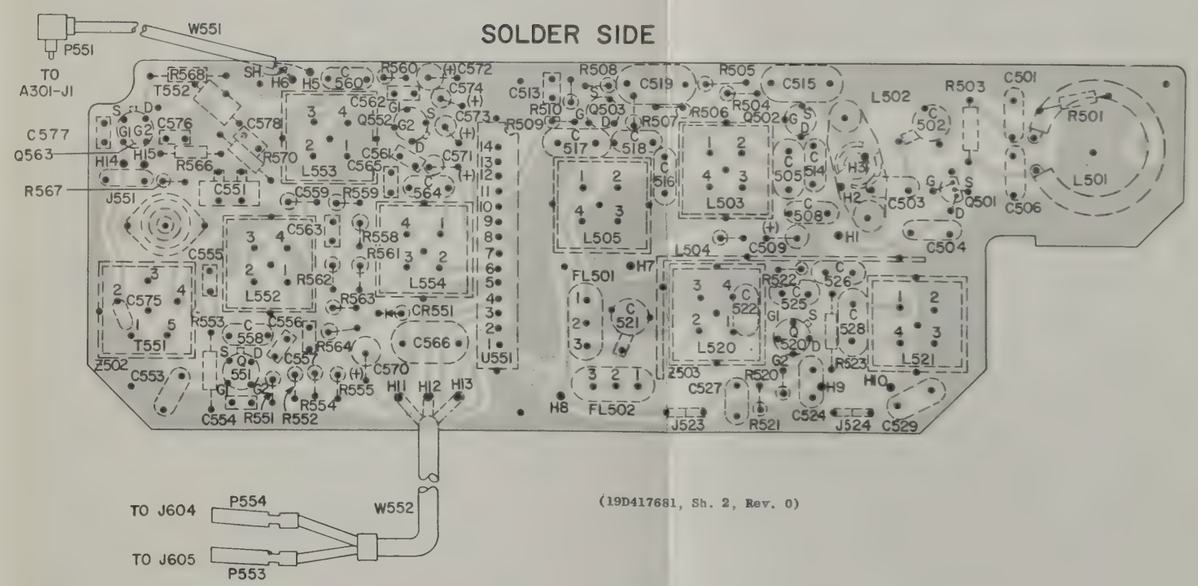
MIXER/IF/NOISE BLANKER BOARD

COMPONENT SIDE



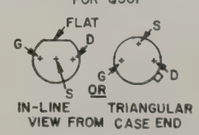
(19D417681, Sh. 2, Rev. 0)
(19D417681, Sh. 3, Rev. 1)

SOLDER SIDE

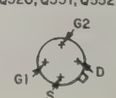


(19D417681, Sh. 2, Rev. 0)

LEAD IDENTIFICATION FOR Q501



Q520, Q551, Q552 & Q553



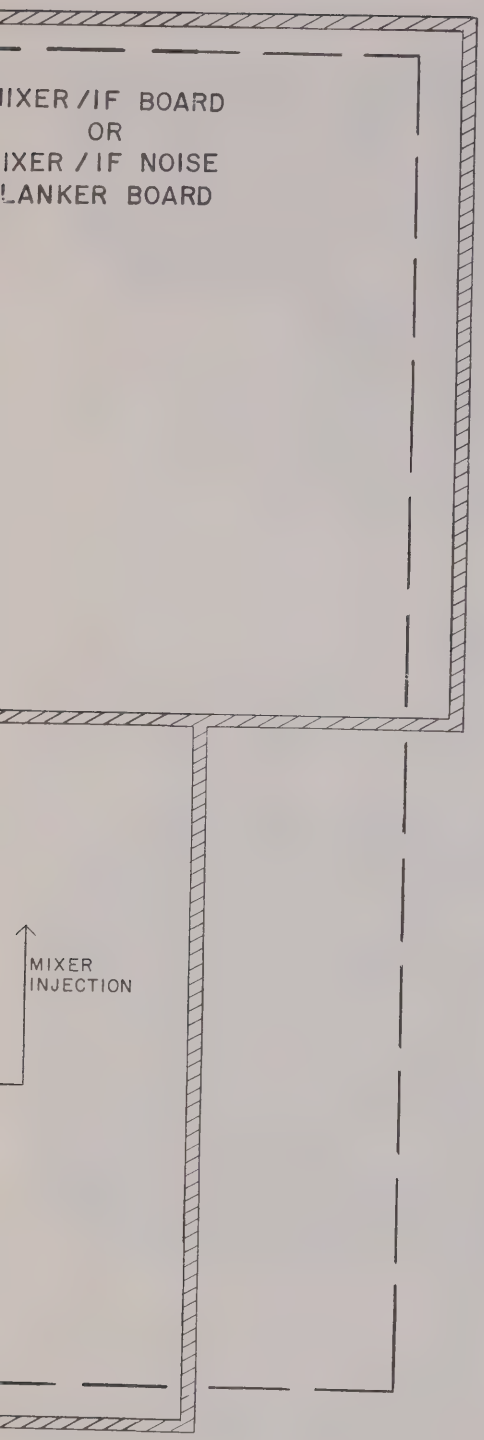
Q502 & Q503

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19D423624, Rev. 1)

OUTLINE DIAGRAM

138—174 MHz RF ASSEMBLY AND MIXER/IF/NOISE BLANKER



	REV. LETTER	FREQ RANGE (MHZ)
RF ASSEMBLY		
19D416693G1	B	138-155
19D416693G2	B	150.8-174

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

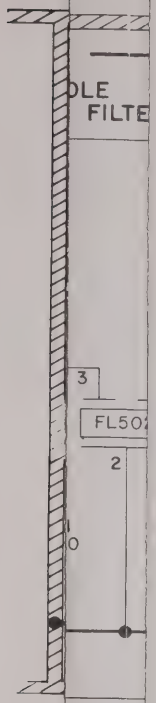
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-10) WITH TEST SET MODEL 4EX3A11 OR A 20,000 OHM-PER-VOLT METER.

⫽ INDICATES A-

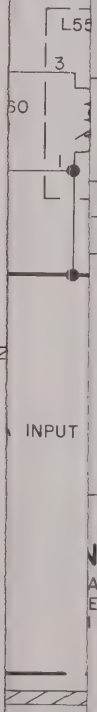
⏚ INDICATES VEHICLE GROUND



* COMPONENT VALUE TABLE		
COMP DESIG	L	H
RF FREQ	138-155 MHZ	150.8-174 MHZ
C2301	10	7

	REV LETTER	FREQ RANGE (MHZ)
MIXER/IF BD		
19D416662 G1	E	138-174

ON IFAS BD. (TO J2305 ON MIF SWITCH FOR DFE)
ON IFAS BD. (TO J2304 ON MIF SWITCH FOR DFE)



▲ THESE COMPONENTS ARE USED TO ADAPT A STANDARD MASTR II RECEIVER TO OPERATE AS AND WITH A DUAL FRONT END. THESE COMPONENTS SHOULD BE IGNORED IN THE STANDARD RECEIVER. BOARDS IDENTIFIED BY A RED DOT HAVE BEEN MODIFIED FOR DFE OPERATION PER MOD. KIT 19A129750G1 OR G2.

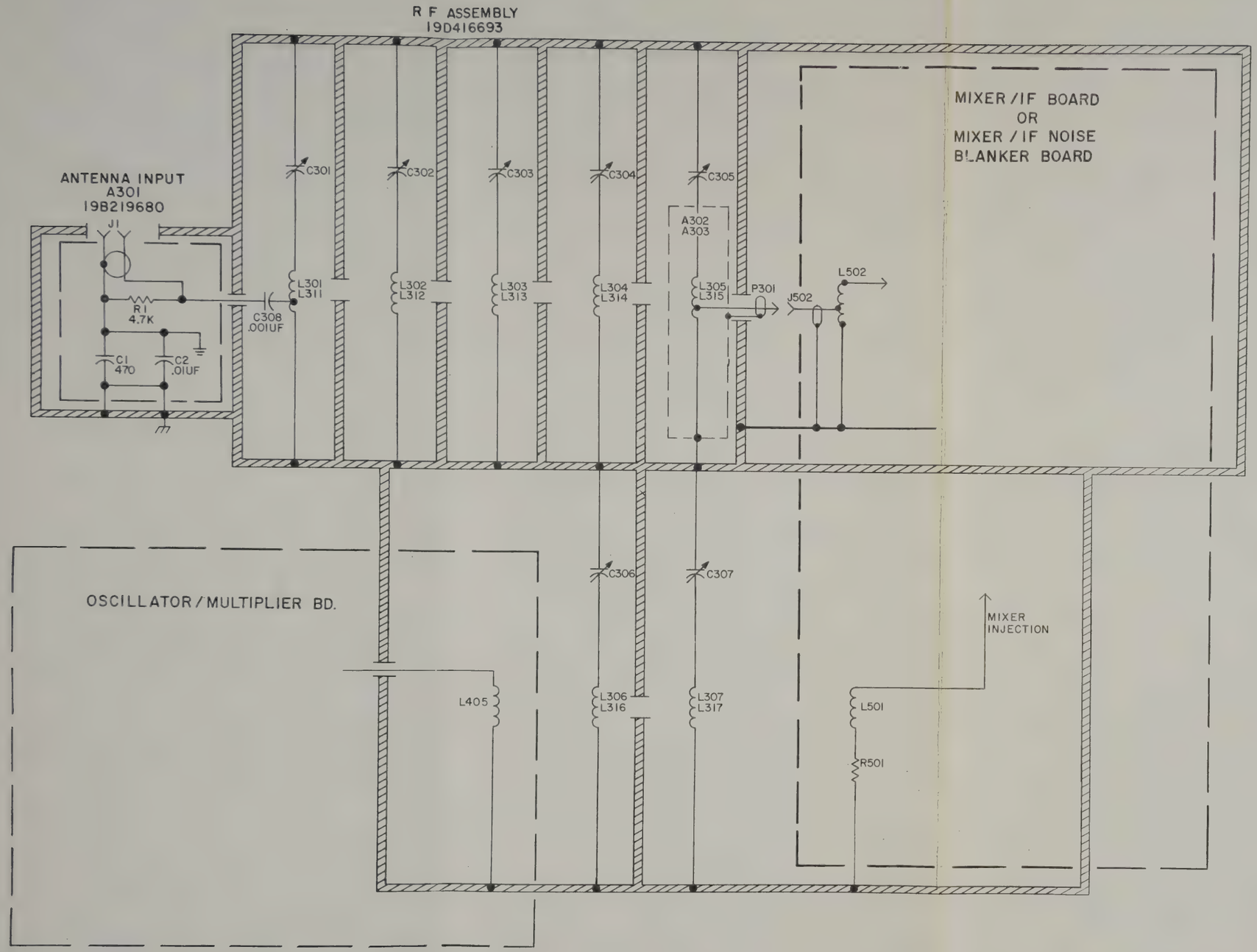
RECEIVER CHANNEL	D. F. E. CHANNEL
ON PL19D416662 (MIXER/IF/BLKR BD)	ON PL19D416662 (MIXER/IF/BLKR BD)
1. R2302 USED INSTEAD OF R523 2. CR2301 USED INSTEAD OF C529 3. R2301 ADDED BETWEEN H9 & H10 THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G1	NO MODIFICATION REQUIRED
	ON PL19D416610 (OSC/MULT BD)
	SEE OSC/MULT BD. FOR OTHER DFE CHANGES THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G2.

NGS
AL READINGS
E (P903-10)
OR A 20,000

SCHEMATIC DIAGRAM

138—174 MHz MIXER/IF/
NOISE BLANKER BOARD

Issue 2



	REV LETTER	FREQ RANGE (MHZ)
RF ASSEMBLY		
19D416693G1	B	138-155
19D416693G2	B	150.8-174

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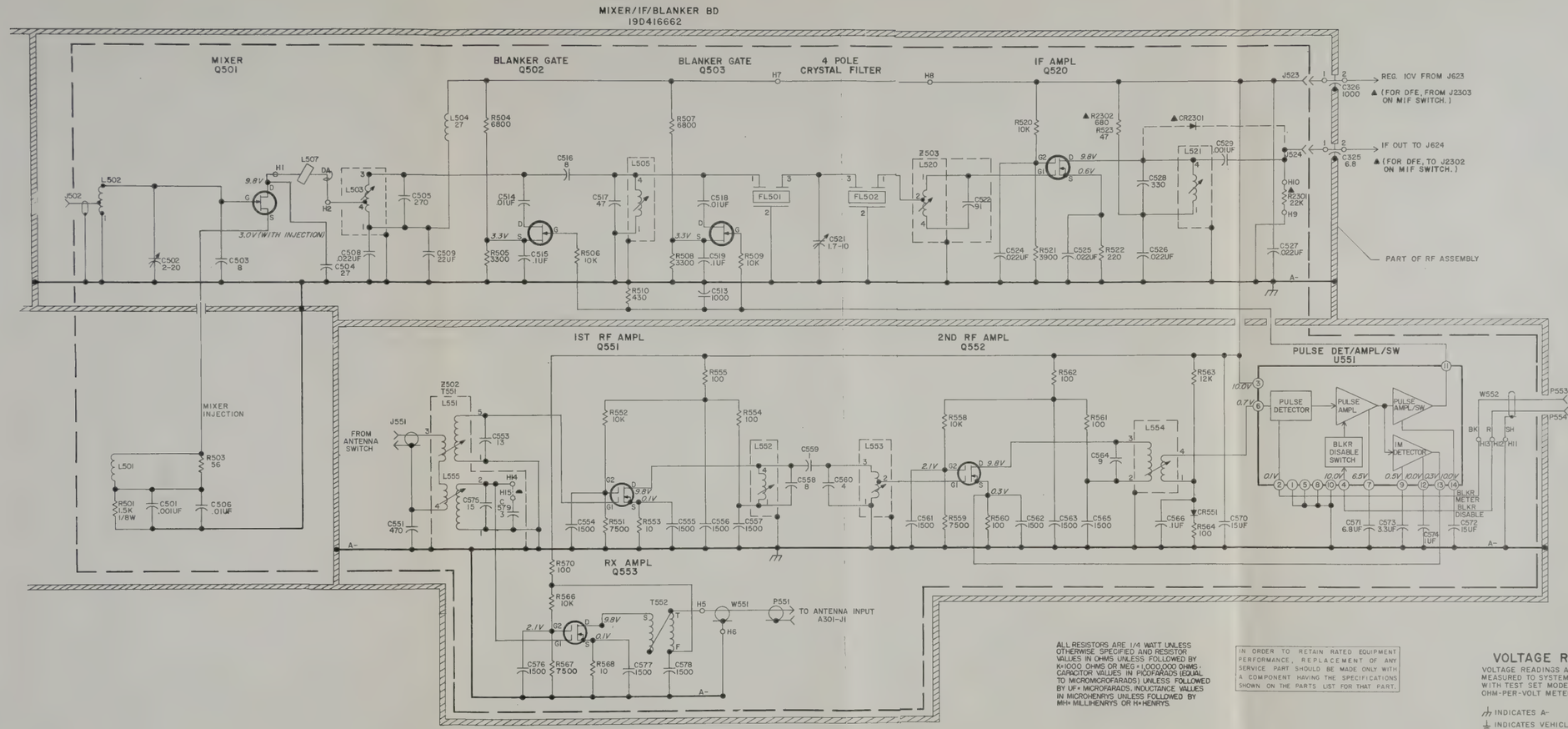
⏥ INDICATES A-

⏚ INDICATES VEHICLE GROUND

(19D423469, Rev. 0)

SCHEMATIC DIAGRAM

138—174 MHz RF ASSEMBLY



✱ COMPONENT VALUE TABLE		
COMP DESIG	L	H
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C2301	10	7

	REV. LETTER	FREQ. RANGE (MHZ)
MIXER/IF BD		
19D416662 G1	E	138-174

▲THESE COMPONENTS ARE USED TO ADAPT A STANDARD MASTR II RECEIVER TO OPERATE AS AND WITH A DUAL FRONT END. THESE COMPONENTS SHOULD BE IGNORED IN THE STANDARD RECEIVER BOARDS IDENTIFIED BY A RED DOT HAVE BEEN MODIFIED FOR DFE OPERATION PER MOD. KIT 19A129750G1 OR G2.

RECEIVER CHANNEL	D.F.E. CHANNEL
ON PL19D416662 (MIXER/IF/BLKR BD)	ON PL19D416662 (MIXER/IF/BLKR BD)
1. R2302 USED INSTEAD OF R523 2. CR2301 USED INSTEAD OF C529 3. R2301 ADDED BETWEEN H9 & H10	NO MODIFICATION REQUIRED
THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G1	ON PL19D416610 (OSC/MULT BD)
	SEE OSC/MULT BD. FOR OTHER DFE CHANGES THESE ITEMS ARE SUPPLIED IN MOD. KIT PL19A129750G2.

ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MEASURED TO SYSTEM NEGATIVE (P903-10) WITH TEST SET MODEL 4EX3A1 OR A 20,000 OHM-PER-VOLT METER.

⏚ INDICATES A-

⏚ INDICATES VEHICLE GROUND

(19B622196, Rev. 1)

SCHEMATIC DIAGRAM

138—174 MHz MIXER/IF/ NOISE BLANKER BOARD

PARTS LIST

LBI-4983A

RF ASSEMBLY
19D416693G1 138-155 MHz
19D416693G2 150.8-174 MHz
AND
MIF ASSEMBLY (NOISE BLANKER)
19D416662G1

SYMBOL	GE PART NO.	DESCRIPTION
A301		ANTENNA INPUT BOARD 19B219680G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116679P470K	Mica: 470 pf ±10%, 250 VDCW.
C2	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - - - -
J1	7104941P16	Connector, phono: Jack; sim to National Tel.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P472K	Composition: 4700 ohms ±10%, 1/4 w.
A302 and A303		COMPONENT BOARD A302 19B226512G1 138-155 MHz A303 19B226512G2 150.8-174 MHz
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L305	19B216112G20	Coil.
L315	19B216112G21	Coil.
		- - - - - - - - - - - - CABLES - - - - - - - - - -
P301	5491689P85	Cable, RF: approx 4 inches long, 350 VRMS, 500 VDC operating voltage.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C301 thru C305		Includes:
	4036765G11	Screw.
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut TOG32005.
C306 and C307		Includes:
	4036765G12	Screw.
	7137968P8	Nut, stamped: thd size No. 6-32; sim to Palnut TOG32005.
C308	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C325	19B209488P1	Ceramic, feed-thru: 6.8 pf ±20%, 500 VDCW; sim to Allen-Bradley Style FA5D.
C326	19B209488P2	Ceramic, feed-thru: 1000 pf +100% -10%, 500 VDCW; sim to Allen-Bradley Style FA5D.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L301	19B216112G19	Coil.
L302 thru L304	19B216112G11	Coil.
L306 and L307	19B204461G18	Coil.
L311	19B216112G17	Coil.
L312 thru L314	19B216112G15	Coil.
L316 and L317	19B204461G19	Coil.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B500969P1	Casting.
	19C320251P1	Cover.
	19B209209P305	Tap screw, Phillips Pozidriv: No. 6-32 x 5/16. (Secures cover).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Used with A301-A303).
		MIF ASSEMBLY (NOISE BLANKER) 19D416662G1
		- - - - - - - - - CAPACITORS - - - - - - - - -
C501	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C502	19B209351P2	Variable, ceramic: 2.5 to 20 pf, 200 VDCW, temp coef -250 +700 PPM/°C; sim to Matshushita ECV-12-W20P32.
C503	19A116656P8K0	Ceramic disc: 8 pf ±1 pf, 500 VDCW, temp coef 0 PPM.
C504	19A116656P27K0	Ceramic disc: 27 pf ±10%, 500 VDCW, temp coef 0 PPM.
C505	5490008P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C506	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C508	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C509	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C513	19A116192P13	Ceramic: 1000 pf ±10%, 50 VDCW; sim to Erie 8121-A050-W5R-102K.
C514	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C515	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C516	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C517	5490008P19	Silver mica: 47 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C518	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C519	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C521	19B209351P1	Variable: 2 to 10 pf, 200 VDCW temp coef +500 -350 PPM; sim to Matshushita ECV-1EW10P32.
C522		(Part of Z503).
C524 thru C527	19A116080P3	Polyester: 0.022 µf ±20%, 50 VDCW.
C528	5490008P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C529	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C551	19A116679P470J	Mica: 470 pf ±5%, 250 VDCW.
C553	19A116656P13J8	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -80 PPM.
C554 thru C557	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-A050-W5R.
C558	19A116656P8J8	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C559	5491601P120	Phenolic: 1.0 pf ±5%, 500 VDCW.
C560	19A116656P4J8	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C561 thru C563	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-050-W5R.
C564	19A116656P9J8	Ceramic disc: 9 pf ±0.5 pf, 500 VDCW, temp coef -80 PPM.
C565	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-A050-W5R.
C566	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C570	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.

SYMBOL	GE PART NO.	DESCRIPTION
C571	5496267P1	Tantalum: 6.8 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C572	5496267P14	Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D.
C573	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C574	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C575		(Part of Z502).
C576 thru C578	19A116192P10	Ceramic: 1500 pf ±20%, 50 VDCW; sim to Erie 8121-A050-W5R.
C579	19A116656P3K8	Ceramic disc: 3 pf ±1 pf, 500 VDCW, temp coef -80 PPM.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR551	19A115250P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E10 and E11	19B209055P8	Terminal, feed-thru: sim to Electrical Ind. AS4S40M53.
		- - - - - - - - - - - - FILTERS - - - - - - - - -
FL501	19B219573G3	Crystal, freq: Pad A: 11,200000 KHz, Pad B: 11,196024 KHz.
FL502		(Part of FL501).
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J502	19A130394G1	Connector, phono type: sim to Cinch National Tel.
J523 and J524	19A116975P1	Receptacle, wire spring.
J551	19A116832P1	Connector, receptacle: sim to Cinch 14R11613.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L501	19A129280P1	Coil.
L502		(Part of printed board 19D417681P1).
L503	19C320141G24	Coil. Includes:
	5493185P9	Tuning slug.
L504	19B209420P130	Coil, RF: 27.0 µh ±10%, 3.60 ohms DC res max; sim to Jeffers 1316-5.
L505	19C320141G23	Coil. Includes:
	5493185P9	Tuning slug.
L507	19A126140P1	Core, toroidal.
L520		(Part of Z503).
L521	19C320141G6	Coil. Includes:
	5493185P9	Tuning slug.
L551		(Part of T551).
L552 and L553	19C320141G25	Coil. Includes:
	5493185P9	Tuning slug.
L554	19C320141G26	Coil. Includes:
	5493185P9	Tuning slug.
L555		(Part of Z502).
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P551		(Part of W551).
P553 and P554		(Part of W552).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q501	19A116154P1	N Channel, field effect.
Q502* and Q503*	19A134137P3	N channel, field effect. Earlier than REV E:
	19A115034P3	N channel, field effect; sim to Type 2N3819.

SYMBOL	GE PART NO.	DESCRIPTION
Q520	19A116818P1	N Channel; sim to Type 3N187.
Q551 thru Q553	19A116818P1	N Channel; sim to Type 3N187.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R501	3R151P152J	Composition: 1500 ohms ±5%, 1/8 w.
R503	3R152P560K	Composition: 56 ohms ±10%, 1/4 w.
R504	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R505	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R506	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R507	3R152P682J	Composition: 6800 ohms ±5%, 1/4 w.
R508	3R152P332J	Composition: 3300 ohms ±5%, 1/4 w.
R509	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R510	3R152P431J	Composition: 430 ohms ±5%, 1/4 w.
R520	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R521	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R522	3R152P221J	Composition: 220 ohms ±5%, 1/4 w.
R523	3R152P470J	Composition: 47 ohms ±5%, 1/4 w.
R551	3R152P753J	Composition: 7500 ohms ±5%, 1/4 w.
R552	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R553	3R152P100K	Composition: 10 ohms ±10%, 1/4 w.
R554 and R555	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R558	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R559	3R152P753J	Composition: 7500 ohms ±5%, 1/4 w.
R560 thru R562	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R563	3R152P123J	Composition: 12,000 ohms ±5%, 1/4 w.
R564	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
R566	3R152P103J	Composition: 10,000 ohms ±5%, 1/4 w.
R567	3R152P753J	Composition: 7500 ohms ±5%, 1/4 w.
R568	3R152P100K	Composition: 10 ohms ±10%, 1/4 w.
R570	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T551		(Part of Z502).
T552	19A127108G1	Coil.
		- - - - - - - INTEGRATED CIRCUITS - - - - - - -
U551	19D417378G1	Noise Blanker.
		- - - - - - - - - - - CABLES - - - - - - - - - -
W551	5491689P87	Cable, RF: approx 2-1/4 inches long, includes (P551).
W552	19B219764G2	Cable, RF: approx 6 inches long. Includes P552-P554.
		- - - - - - - - - - NETWORKS - - - - - - - - - -
Z502		COIL ASSEMBLY 19C321174G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C575	5496218P244	Ceramic disc: 15 pf ±5%, 500 VDCW, temp coef -80 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L555	19C321174P2	Coil. Includes:
	5493185P11	Tuning slug.

SYMBOL	GE PART NO.	DESCRIPTION
Z503		COIL ASSEMBLY 19C320141G16
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C522	19A116114P1063	Ceramic: 91 pf ±5%, 100 VDCW; temp coef -3300 PPM.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L520	19C320141P26	Coil. Includes:
	5493185P9	Tuning slug.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19B219470P2	Shield.
	19A129424G1	Can. (Used with L503, L505, L521, L552-L554, Z503).
	19A129424G2	Can. (Used with Z502).
	4035656P35	Spacer, threaded. (Used with J502).
	NS0P13004C6	Screw, phillips: No. 6-32 x 1/4. (Secures J502).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A thru D – Mixer/IF/Noise Blanker Board 19D416662G1

REV. A and B – RF Assembly 19D416693G1,2

Above revisions incorporated in initial shipment.

REV. E – Mixer/IF/Noise Blanker Board 19D416662G1

To improve blanker operation. Changed Q502 and Q503.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

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REV. E - Mixer/IF/Noise Blanker Board 19D416662G1

To improve blanker operation. Changed Q502 and Q503.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number followed by description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Station or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model Number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-1107

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

MOBILE RADIO

CUSTOM MVP MAINTENANCE MANUAL

406-512 MHz, 35 WATT TRANSMITTER

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SPECIFICATIONS ii

DESCRIPTION AND MAINTENANCE LBI30587 (DF3164)

EXCITER LBI30060 (DF3165)

POWER AMPLIFIER LBI30586 (DF3166)

GENERAL ELECTRIC

Maintenance Manual LBI30564 A

(DF3164, THIS SHEET ONLY)

406-512 MHz 35-WATT Custom MVP TRANSMITTER

SPECIFICATIONS*

FCC FILING NUMBER	KT-161-A, C
POWER OUTPUT	35-Watts Adjustable from 20 to 35 Watts (406-494 MHz) Adjustable from 20 to 30 Watts (494-512 MHz)
CRYSTAL MULTIPLICATION FACTOR	36
FREQUENCY STABILITY Crystal Module ICOM	 ±0.0005% ±0.0002%
SPURIOUS AND HARMONIC EMISSION (Per EIA RS-152-B, Part 4)	At least 70 dB below rated power output
MODULATION	Adjustable from 0 to ±5 kHz swing with instantaneous modulation limiting.
MODULATION SENSITIVITY	75 to 120 Millivolts
AUDIO FREQUENCY CHARACTERISTICS	Within +1 to -3 dB of a 6-dB/octave pre-emphasis from 300 to 3000 Hz per EIA standards. Post limiter filter per FCC and EIA.
DISTORTION	Less than 5% (300 to 3000 Hz)
DEVIATION SYMMETRY	0.6 kHz maximum

MAXIMUM FREQUENCY SPREAD:

	Full Specifications	1 dB Degradation
406-420 MHz	5.0 MHz	9.00 MHz
450-470 MHz	5.50 MHz	9.00 MHz
470-512 MHz	6.0 MHz	9.75 MHz

DUTY CYCLE	EIA 20% Intermittent
RF OUTPUT IMPEDANCE	50 ohms

* These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

WARNING

Although the highest DC voltage supplied to the transmitter is +12 VDC, high currents may be drawn under short circuit conditions. These currents can possibly heat metal objects such as tools, rings, watchbands, etc., enough to cause burns. Be careful when working near energized circuits!

High-level RF energy in the transmitter Power Amplifier assembly can cause RF burns upon contact. Keep away from these circuits when the transmitter is energized!

MOBILE RADIO

DESCRIPTION AND MAINTENANCE

406—512 MHz, 35-WATT CUSTOM MVP TRANSMITTER

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DESCRIPTION

Custom MVP transmitters are crystal controlled, phase modulated transmitters designed for one through four frequency operation in the 406-512 MHz frequency band. This solid state, high reliability transmitter uses one integrated circuit and discrete components to provide 35 watts of transmitted RF power. The transmitter consists of:

•Exciter Board: with oscillator, audio, modulator, amplifier and multiplier stages.

•Power Amplifier Assembly; with two amplifiers, driver, PA final, power adjust circuit and low pass filter and antenna transfer relay assembly.

•Multi-frequency board; used in multi-frequency radios (0.0005% only).

•Transmit oscillator board (0.0002% stability); used in single frequency applications only. The output of the transmit oscillator board is fed to crystal module pins on the Exciter board.

Figure 1 is a block diagram of the 406-512 MHz Custom MVP transmitter, showing the exciter, PA and multi-frequency boards.

The exciter contains the oscillator, audio IC, modulator and multipliers to provide 200 milliwatts of modulated RF power to the power amplifier.

The power amplifier assembly includes four RF transistor stages (two amplifiers, a driver and power amplifier), a low pass filter and a power adjust circuit. The output power is adjustable from 20-watts to rated output power (EIA), and from 1-watt to rated poutput power (FCC).

MAINTENANCE

DISASSEMBLY

To service the transmitter remove the wing nut at the rear of the radio and pull the radio out of case assembly.

To remove exciter board:

1. Unplug cables W201 (exciter output) and when present W2602 (multi-frequency cable).

2. Remove the six screws holding the exciter board to the mounting frame and gently lift exciter board out of radio.

NOTE

When removing or replacing the PA board it is necessary to first remove the exciter board to allow installation of the PA transistor mounting hardware.

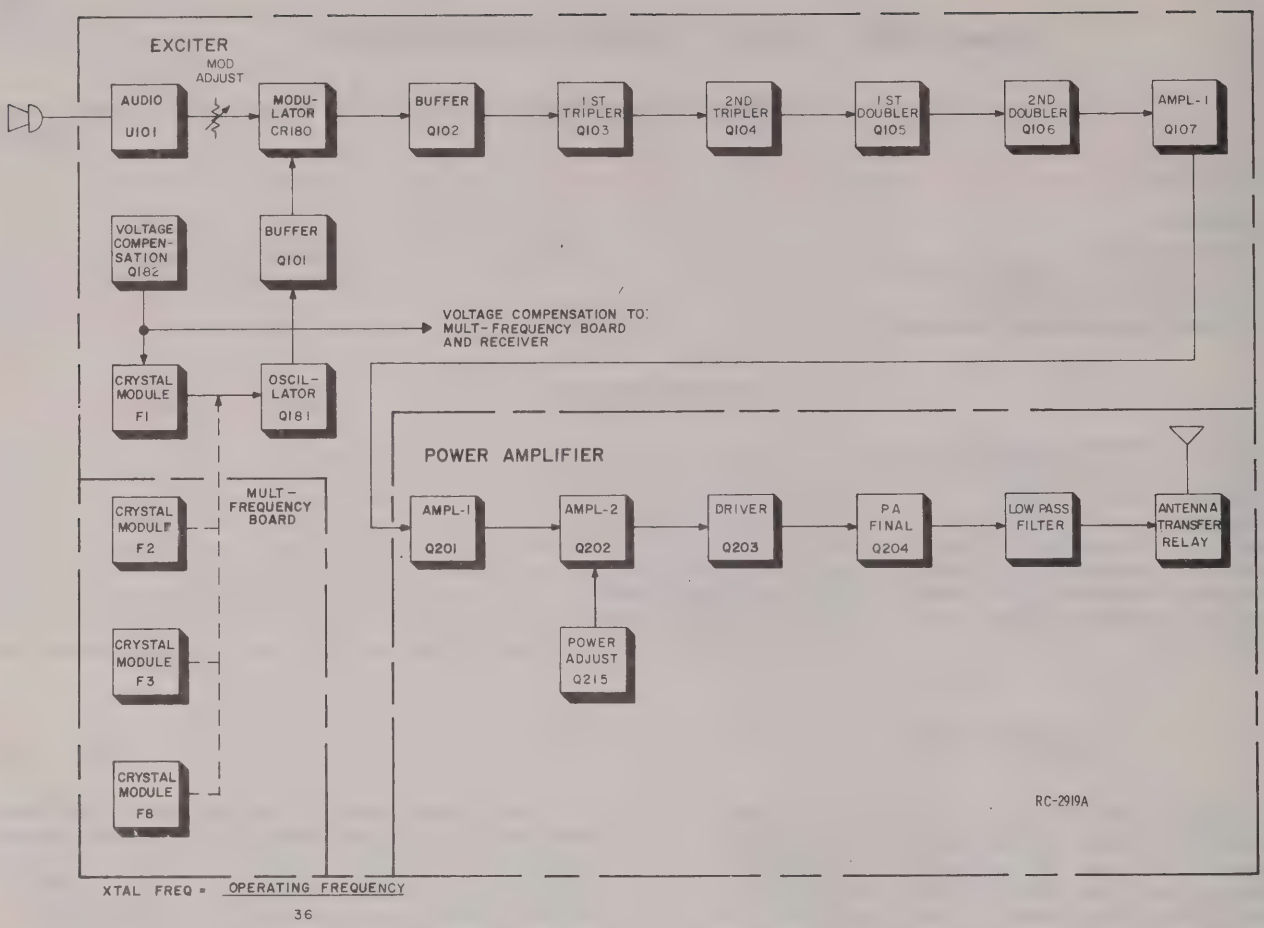


Figure 1 - Transmitter Block Diagram

To remove PA Board:

1. Unplug the exciter/PA cable from J1. Then unsolder the center conductor of the PA/low pass filter cable W214 from W5. The shield will come loose when the PA board mounting screws are removed.

2. Unsolder power lead W203 at E1 and at C203 and remove the retaining screw from power adjust transistor Q215. Be careful not to damage the mica insulator between the transistor and the chassis.

3. Invert the chassis and remove the PA transistor (Q202) hold-down nut and spring washer on the rear of the PA assembly.

4. Remove the nuts securing the flange transistors to the PA mounting shelf.

5. Remove the five PA board mounting screws, and lift the board out.

PA TRANSISTOR REPLACEMENT

WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

- To remove PA RF transistor Q202:

  (1) Unsolder one lead at a time with a 50-watt soldering iron. Use a scribe or X-acto® knife to hold the lead away from the printed circuit board until the solder cools.

  (2) Turn the PA board over.

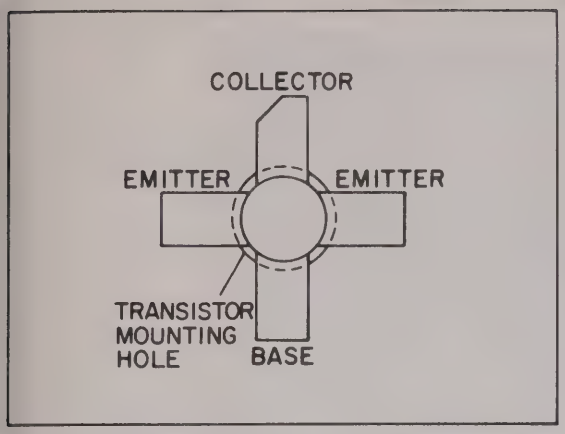


Figure 2 - Lead Identification

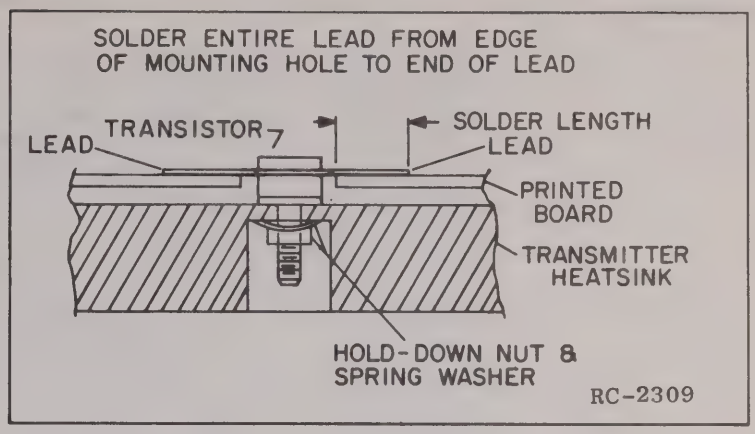


Figure 3 - Lead Forming

(3) Hold the body of the transistor to prevent it from turning. Remove the transistor hold-down nut and spring washer through the hole in the heatsink with an 11/32-inch nut-driver for Q202. Lift out the transistor, and remove the old solder from the printed circuit board with a de-soldering tool such as a SOLDA PULLT®. Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.

•To remove RF PA transistors Q203 and Q204 (Flange type):

(1) Unsolder one lead at a time with a 50-Watt soldering iron. Use a scribe or X-acto® knife to hold the lead away from the printed circuit board until the solder colls. Special care should be taken to prevent damage to the printed circuit board runs because part of the matching network is included in the base and collector runs.

To replace RF PA transistors:

(1) Trim the new transistor leads (if required) to the lead length of the removed transistor. See Figure 4 for lead identification of Q203 and Q204. Cut the collector lead of Q202 at a 45° angle for future identification. See Figure 2). The letter "C" on the top of each transistor also indicates the collector.

(2) Apply a coat of silicon grease around the transistor mounting surface, and place the transistor in the mounting hole. Align the leads as shown on the Outline Diagram. Then hold the body of the transistor and replace the hold-down nut and spring-washer (Q202) or the two retaining screws (Q203 and Q204) using moderate torque, 8 inch-pounds for Q202 or 6 inch-pounds for Q203 and Q204. A torque wrench must be used for this adjustment since transistor damage can result if too little or too much torque is used.

(3) Make sure that the transistor leads are formed as shown in Figure 3 (Q202) so that the leads can be soldered to the printed circuit pattern, starting from the inner edge of the mounting hole.

(4) Solder the leads to the printed circuit pattern. Start at the inner edge of mounting hole and solder the remaining length of transistor lead to the board. Use care not to use excessive heat that causes the printed wire board runs to lift up from the board. Check for shorts and solder bridges before applying power.

CAUTION

Failure to solder the transistor leads as directed may result in the generation of RF loops that could damage the transistor or may cause low power output.

TROUBLESHOOTING

A Troubleshooting Procedure, including QUICK CHECKS® permits rapid fault location in the exciter and power amplifier.

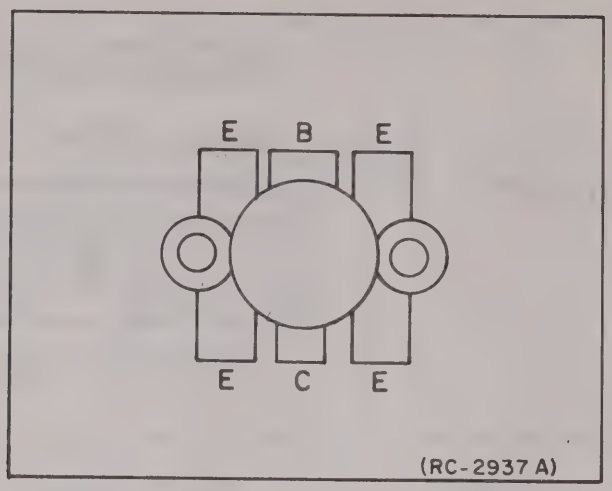


Figure 4 - Lead Identification for Q203 and Q204

CAUTION

Before bench testing the Custom MVP Mobile Radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltage limits must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohm resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 15.5 Volts

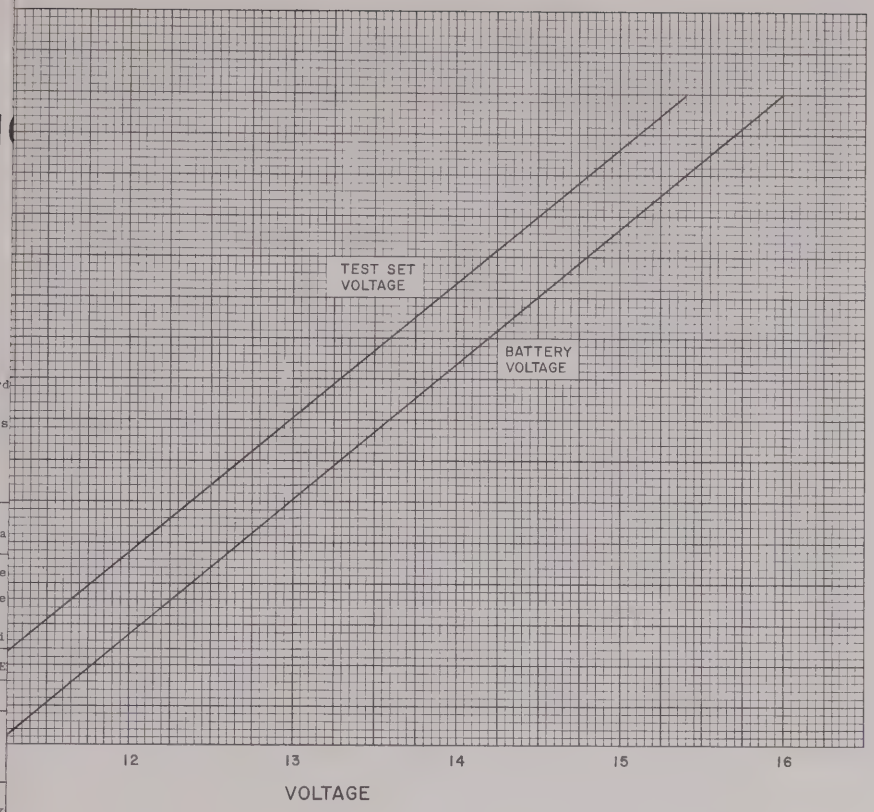
These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes). Input voltages must not exceed the limits shown above, even for transient peaks of short duration.

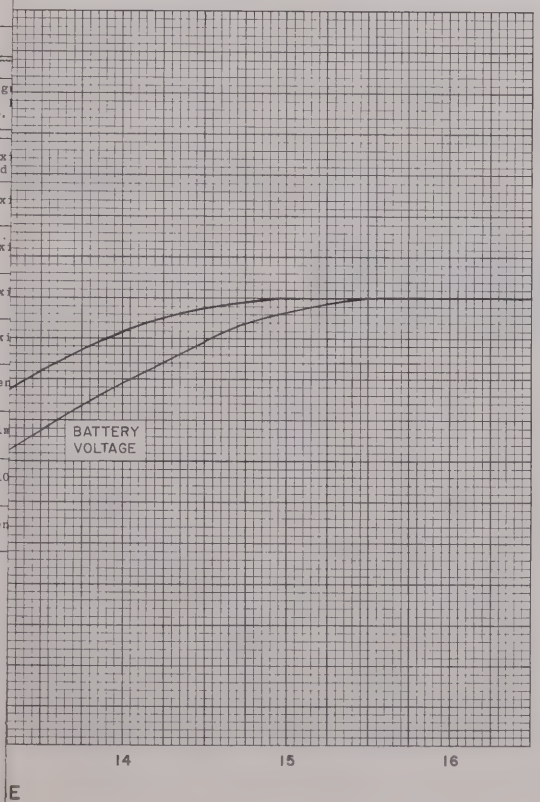
Many commonly used bench power supplies cannot meet these requirements for load regulation and transient voltage suppression. Bench supplies which employ "brute force" regulation and filtering (such as Lapp Model 73) may be usable when operated in parallel with a 12-Volt automotive storage battery.

TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A deviation meter
3. A 20,000 ohms-per-volt multimeter
4. GE Test Set Model 4EX3A11 or 4EX8K12
5. AC Voltmeter
6. Frequency counter
7. Wattmeter
8. Oscilloscope



igure 7 - 450-470 MHz Power Output Setting Chart



Power Output Setting Chart

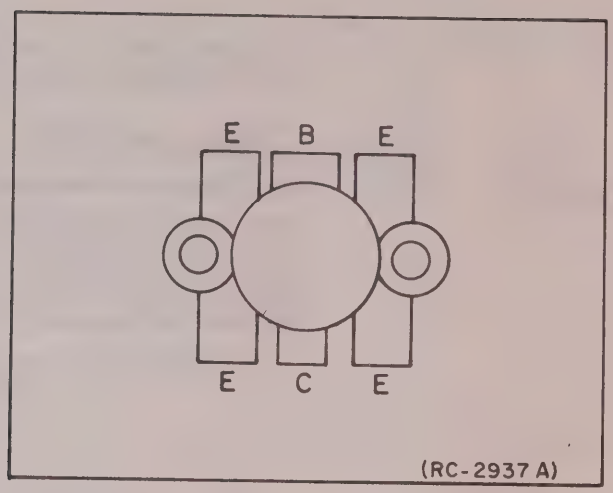


Figure 4 - Lead Identification for Q203 and Q204

CAUTION

Before bench testing the Custom MVP Mobile Radio, be sure of the output voltage characteristics of your bench power supply.

To protect the transmitter power output transistors from possible instant destruction, the following input voltage limits must not be exceeded:

Transmitter unkeyed: 20 Volts
Transmitter keyed (50 ohm resistive load): 18 Volts
Transmitter keyed (no load or non-resistive load): 15.5 Volts

These voltages are specified at the normal vehicle battery terminals of the radio and take the voltage drop of standard cables into account. The voltage limit shown for a non-optimum load is for "worst case" conditions. For antenna mismatches likely to be encountered in practice, the actual limit will approach the 18 Volt figure.

Routine transmitter tests should be performed at EIA Standard Test Voltages (13.6 VDC for loads of 6 to 16 amperes). Input voltages must not exceed the limits shown above, even for transient peaks of short duration.

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TEST EQUIPMENT

1. An audio oscillator (GE Model 4EX6A10)
2. A deviation meter
3. A 20,000 ohms-per-volt multimeter
4. GE Test Set Model 4EX3A11 or 4EX8K12
5. AC Voltmeter
6. Frequency counter
7. Wattmeter
8. Oscilloscope

MODULATION LEVEL ADJUSTMENT

The MOD ADJUST R104 has been adjusted to the proper setting before shipment and should not normally require readjustment. This setting permits approximately 75% modulation for the average rms level.

PROCEDURE

1. Connect the audio oscillator and the meter across audio input terminals J10 (Green-Wire) and J11 (Black-Wire) through a 6.2 kilohm resistor. Connect the (+) meter lead (Red) through a 6.2 kilohm resistor for largest PC blocking capacitor, and PROBE (White Lead) on the further board.
2. Adjust the audio oscillator for 1-Volt RMS at 1000 Hz.
3. For transmitters without Channel Guard, set MOD ADJUST R104 for a 4.5 kHz swing using the deviation polarity that produces the highest reading on the deviation meter. If deviation varies more than ±0.5 kHz, recheck Step 1 under Transmitter Alignment.

NOTE

Tone deviation should be rechecked each time the tone frequency is changed.

4. Tone Deviation for transmitters with Channel Guard, set MOD ADJUST R043 for zero tone deviation. Next, with the 1-Volt signal at 1000 Hz applied, set MOD ADJUST R104 for 2.75 kHz deviation. Then remove the signal from the audio oscillator and set Channel Guard MOD ADJUST R043 for 0.75 kHz tone deviation.
5. For multi-frequency transmitters, re-do the deviation as described in Steps 3 or 4 on the channel producing the largest amount of deviation.

PA POWER INPUT

For FCC purposes, the PA power input can be determined by measuring the PA supply voltage and PA current using the following formula:

P_i = PA voltage x PA current

Where:

P_i is the power input in watts,

PA voltage is measured with Test Set Model 4EX21A11 in Position C on the 15-volt range (read as 15 Volts full scale), and with the polarity switch in the (+) position. With Test Set Model 4EX21C, use the B+ position and the 1-Volt range (read as 15 Volts full scale) with the HIGH SENSITIVITY button pressed and the polarity switch in the (+) position.

PA current is measured with the Test Set in Position C in the Test 1 position, and with the HIGH SENSITIVITY button pressed (read as 15 amperes full scale).

Example

P_i = 13.0 Volts x 6.0 Amperes = 78 Watts

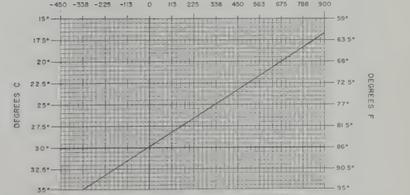


Figure 5 - Frequency Offset Chart

CRYSTAL MODULE FREQUENCY ADJUSTMENT

First, check the frequency to determine if any adjustment is required. The frequency should be set using a frequency meter or counter with an absolute accuracy that is 5 to 10 times better than the tolerance to be maintained, and with the entire radio as near as possible to an ambient temperature of 30°C (86°F).

The oscillator should be reset only when the frequency shown deviation in excess of the following limits:

A. ±0.6 PPM, when the radio is at 30°C (86°F).

B. ±5 PPM at any other temperature within the range of -30°C to +75°C (-22°F to +167°F).

If an adjustment is required, proceed as follows:

If the radio is at an ambient temperature of 30°C (86°F), set the oscillator for correct operating frequency.

If the radio is not at an ambient temperature of 30°C, setting errors can be minimized as follows:

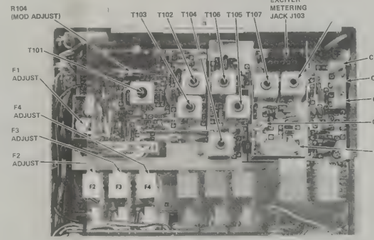
A. To hold the setting error to ±0.6 PPM (which is considered reasonable for 5 PPM crystal oscillators):

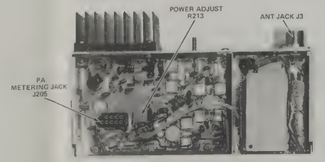
1. Maintain the radio at 30°C and set the oscillator to desired frequency, or

2. Maintain the radio at 30°C (+5°C, -15°C) offset the operating frequency as a function of actual temperature, by the amount shown in Figure 5.

For example: Assume the ambient temperature of the radio is 20°C (68°F). At that temperature, the curve shows a correction factor of 675 Hz.

Set C3 on the selected crystal module for a reading of 675 Hz higher than the licensed operating frequency. If a negative correction factor is obtained (at temperatures above 30°C), set the oscillator for the indicated frequency lower than the licensed operating frequency.





TRANSMITTER ALIGNMENT

EQUIPMENT

1. A 50-ohm wattmeter connected to antenna jack J3.
2. A frequency counter
3. Deviation monitor.

PRELIMINARY CHECKS AND ADJUSTMENTS

1. Place crystal modules for F1 on Exciter Board and F3-F4 on multi-frequency board, (crystal frequency - operating frequency ±36). In wireless applications where a stability of ±0.0002% is required, 1000Hz are used. Place all 1000Hz on the multi-frequency board.
2. For a large change in frequency or a badly mis-aligned transmitter, preset all slugs to the top of the coil form.
3. Set output impedance matching capacitor to 1/4 mesh.
4. Set all other air variable capacitors to minimum capacity (not meshed).

NOTE

The tuning frequency for multi-frequency transmitters is determined by the operating frequency and the frequency spread between transmitters. Refer to the table below for maximum frequency spread.

5. For multi-frequency transmitters with a frequency spread less than that specified in column (1) tune the transmitters to the lowest frequency. For a frequency spread exceeding the limits specified in column (1) tune the transmitters using a center frequency tune up procedure as required. The maximum frequency spread can be extended to the limits specified in column (3) with 1 dB degradation.

Multi-Frequency Transmitter Tuning

Transmitter Frequency Range	MAXIMUM FREQUENCY SPREAD		
	(1) Without center tuning	(2) With center tuning	(3) With center tuning (1 dB degradation)
406-420 MHz	2.50 MHz	5.00 MHz	8.00 MHz
450-470 MHz	2.75 MHz	5.50 MHz	8.00 MHz
470-512 MHz	3.00 MHz	6.00 MHz	9.75 MHz

6. Connect the red plug on the QE test set to the SAS Board metering jack, and the black plug to the Exciter metering jack. Set the polarity (+ or -) and set the range to the Test 1 position (1-Volt) position for 4EX8A17; for all adjustments.

NOTE: With the Test Set connected to the PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to Driver collector current by reading the current as 15 amperes full scale. The voltage reading at position "G" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 15 amperes full scale.

7. Set power adjust R13 on PA Board full counterclockwise. All adjustments are made with the transmitter keyed.

NOTE

When the need for minor adjustments to the transmitter are indicated, perform steps 13 through 17 for a quick transmitter tune-up.

ALIGNMENT PROCEDURE

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
				NOTE When aligning transmitter, proceed as instructed below. DO NOT retune a previously tuned control unless specifically directed to do so.
1.	F (4EX7-1)	T101, T102 & T103	See Procedure	Tune T101 for maximum meter reading. Then tune T102 for a dip (small) in meter reading and tune T103 for maximum meter reading.
2.	C (4EX7-2)	T104 and T105	See Procedure	Tune T104 for maximum meter reading, then tune T105 for a dip (small) in meter reading.
3.	D (4EX7-3)	T106 and T107	See Procedure	Tune T106 for maximum meter reading and then tune T107 for a dip in meter reading.
4.	E (4EX7-4)	T108 and C155	See Procedure	Tune T108 for maximum meter reading and then tune C155 for a dip in meter reading.
5.	F (4EX7-1)	C157 and C167	See Procedure	Tune C157 for maximum meter reading, and then tune C167 for a dip in meter reading
6.	A (Rel. Power Out)	C171 and C175	Maximum	Tune C171 and then C175 for maximum meter reading.
7.	F (4EX7-1)	T101	Maximum	Tune 101 for maximum reading.
8.	C (4EX7-2)	T102, T103 & T104	Maximum	In order, tune T102, T103 and T104 for maximum meter reading.
9.	D (4EX7-3)	T105 and T106	Maximum	Tune T105 and then T106 for maximum meter reading.

ALIGNMENT PROCEDURE (Cont'd)

STEP	METER POSITION	TUNING CONTROL	METER READING	PROCEDURE
10.	F (4EX7-4)	T107 and T108	Maximum	Tune T107 and then T108 for maximum meter reading.
11.	G (4XPL-1)	C155 and C157	Maximum	Tune C155 and then C157 for maximum meter reading.
12.	A (Rel. Power Out)	C167, C171 & C175	Maximum	In order, tune C167, C171 and C175 for maximum meter reading.
				NOTE A quick transmitter tune-up procedure is provided in steps 13 through 17.
13.	C (4EX7-2)	T103, T103 and T104	Maximum	Alternately tune T103, T103 and T104 for maximum meter reading.
14.	D (4EX7-3)	T105 and T106	Maximum	Alternately tune T105 and T106 for maximum meter reading.
15.	F (4EX7-4)	T107 and T108	Maximum	Alternately tune T107 and T108 for maximum meter reading.
16.	G (4XPL-1)	C155 and C157	Maximum	Alternately tune C155 and C157 for maximum meter reading. For optimum operation repeat steps 12 through 16.
17.	A (Rel. Power Out)	C167, C171 and C175	Maximum	Alternately tune C155, C171 and C175 for maximum meter reading.
18.		R213		NOTE Remove the metering plug from the exciter and connect it to PA metering jack J5. With meter in position D repeak C167, C171 and C175 for maximum. With the battery voltage at 13.6 Volts or the PA collector voltage at 13.0 Volts, set Power Adjust potentiometer R213 on the PA board for the desired power output from 1 to 35 watts. If the battery voltage is not at 13.6 Volts or the collector voltage at 13.0 Volts and full rated output is desired, set R213 for the output power according to the battery voltage or collector voltage shown in Figure 6, 7, or 8. NOTE: With the Test Set connected to the PA metering jack, the voltage reading at position "F" with the HIGH SENSITIVITY button pressed may be converted to driver collector current by reading the current as 15 amperes full scale. The voltage reading at position "G" with the HIGH SENSITIVITY button pressed may be converted to PA collector current by reading the current as 15 amperes full scale. NOTE The PA collector voltage is measured as described in the PA POWER INPUT section.

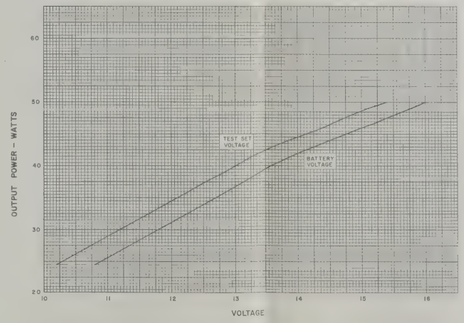


Figure 6 - 406-420 MHz Power Output Setting Chart

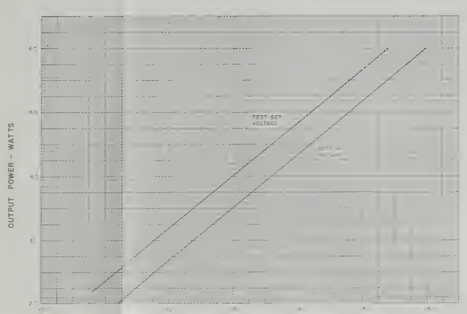


Figure 7 - 450-470 MHz Power Output Setting Chart

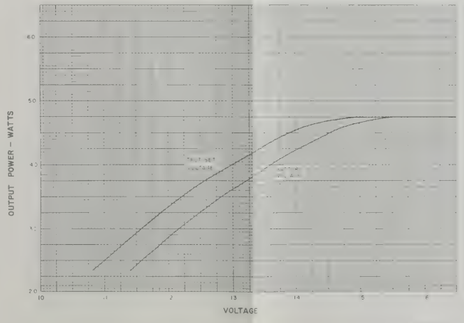
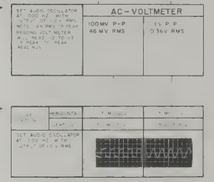


Figure 8 - 470-512 MHz Power Output Setting Chart

STEP 1 - QUICK CHECKS

Connect CE Test Set to Exciter or PA metering jack as required.

WITH MODULATION, CE TEST SET	Measurable Defective Stage		
	HIGH METER READING	LOW METER READING	ZERO METER READING
EXCITER			
B (MULT-1)	Q102, Q103, T102	Q102, Q103 T102	Q102, Q103, T102
C (MULT-2)	Q104, T105	T102, T103 Q104, T104	T102, T104, Q104 T105, T103
D (MULT-3)	Q105, T107	T105, T106, Q105	T105, T106, Q105, T107
F (MULT-4)	Q106, C155	Q106, T107, T108	Q106, T107, T108 L104
G (AMPL-1)	Q107, L113	Q107, C115 - C157	Q107, C155 - 157 L107
A (Power Out)	W216	CR181, C190 Q107	CR181,C190,Q107 C187,C171,C173
POWER AMPLIFIER			
E (Power Control)	Q715, R213	Q715, R213	Q715, R213
"B" (DRIVER CURRENT)	Q203	Q203, Low Output from Exciter CR201	No output from Exciter CR201, C203
"C" (PA CURRENT)	Q204	Q201, Q202 Q204, Q203	Q202, Q203, Q201, Check Pos. C & D
			Q704, Q703, Q202 Q201, Q715



STEP 3
CHECK AUDIO AC VOLTAGES

STEP 4
AUDIO & OSC WAVEFORMS

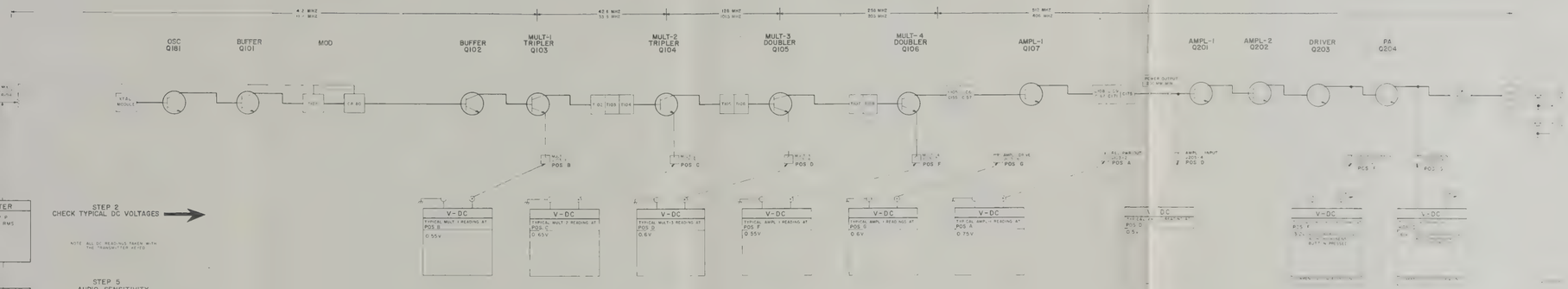
STEP 2
CHECK TYPICAL DC VOLTAGES

NOTE: ALL DC READINGS TAKEN WITH THE TRANSMITTER KEYED

STEP 5
AUDIO SENSITIVITY

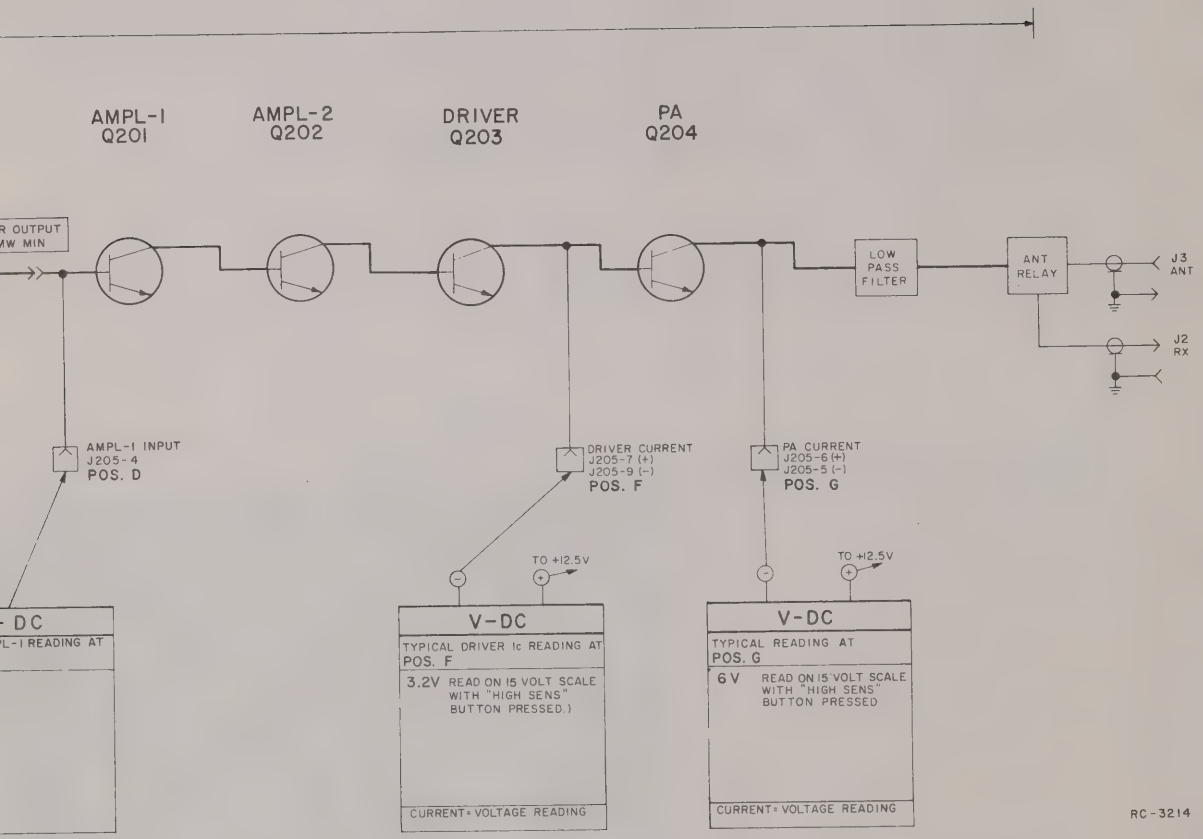
WITHOUT CHANNEL GUARD
REMOTE AUDIO OSCILLATOR OUTPUT UNTIL DEVIATION FALLS TO 3.0 KHz. VOLTAGE SHOULD BE LESS THAN 100 MILLIVOLTS

WITH CHANNEL GUARD
REMOTE AUDIO OSCILLATOR OUTPUT UNTIL DEVIATION FALLS TO 2.0 KHz. VOLTAGE SHOULD BE LESS THAN 100 MILLIVOLTS



TROUBLESHOOTING PROCEDURE

406—512 MHz, CUSTOM MVP
35-WATT TRANSMITTER


AMPL-1
Q201
AMPL-2
Q202
DRIVER
Q203
PA
Q204
LOW PASS FILTER
ANT RELAY
J3 ANT
J2 RX
AMPL-1 INPUT
J205-4
POS. D
DRIVER CURRENT
J205-7 (+)
J205-9 (-)
POS. F
PA CURRENT
J205-6 (+)
J205-5 (-)
POS. G
TO +12.5V
V-DC
TYPICAL DRIVER Ic READING AT POS. F
3.2V READ ON 15 VOLT SCALE WITH "HIGH SENS" BUTTON PRESSED.)
CURRENT = VOLTAGE READING
TO +12.5V
V-DC
TYPICAL READING AT POS. G
6 V READ ON 15 VOLT SCALE WITH "HIGH SENS" BUTTON PRESSED
CURRENT = VOLTAGE READING
RC-3214

GE MOBILE RADIO

10 watt

MAINTENANCE MANUAL

138—174 MHz POWER AMPLIFIER 19D423927G2

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CIRCUIT ANALYSIS ..... Page 1
OUTLINE DIAGRAM ..... Page 2
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PARTS LIST AND PRODUCTION CHANGES ..... Page 4

DESCRIPTION

The PA assembly for Custom MVP uses two RF power transistors to provide a power output of 10 watts. The output power is adjustable from 1.5 to 10 watts by power adjust potentiometer R8. A single transistor is used in the power adjust circuit.

Supply voltage (A+) for the PA is connected from jack J1 on the back of the unit through FL210-C5 on the side of the radio. C201, C202 and L12 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse in the fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J205 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters power control voltage, Ampl-1 drive (exciter output), and PA voltage and current.

CIRCUIT ANALYSIS

RF AMPLIFIERS

The exciter output is coupled through an RF cable to PA input jack J201. The RF is coupled through a matching network to the base of Class C amplifier Q1. The network matches the 50-ohm input to the base of Q1 and consists of T1, C4, C5 and C39. L1 and R13 comprise a stabilizing network in the base circuit of Q1.

Part of the RF input is rectified by CR1 and applied to voltage divider R1 and R2. This voltage is used to meter the AMPL-1 drive at J205.

Collector voltage to Q1 (Ampl-1) is controlled by power control transistor, Q215 and is applied through a collector stabilizing and feed network consisting of C6, L3, L4 and R4. The collector voltage of Q201 is metered through R7 at J5.

The output of Q1 is coupled to the base of PA transistor Q2 through a matching network consisting of L5, L6, C12, C13, C14 and R5. Collector voltage to Q2 is applied through collector stabilizing and feed network C15, L8, L11 and R6.

Collector current for Q2 is metered across tapped manganin resistor R9 at J205. (PA current). The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 10 amperes full scale.

Following Q2 is a matching network (L9, L10, W2, C20 and C21) that matches the output of Q2 to the 50-ohm microstrip impedance (W1) in the low pass filter. C22 acts as a DC blocking capacitor.

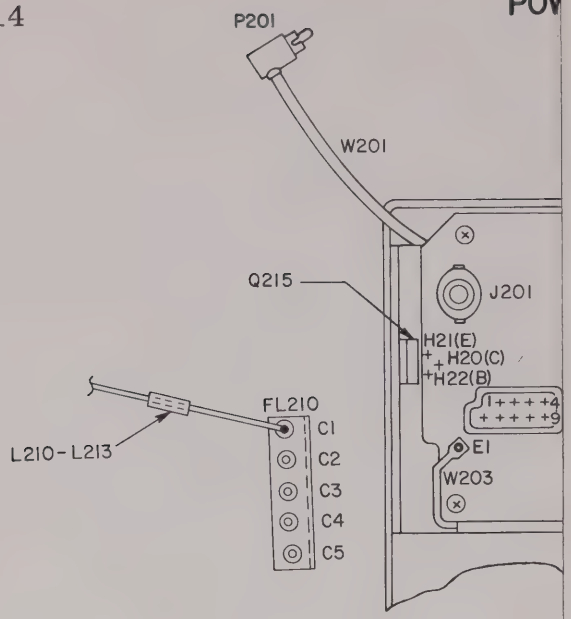
The PA output is coupled through the low-pass filter to the antenna through antenna relay K1.

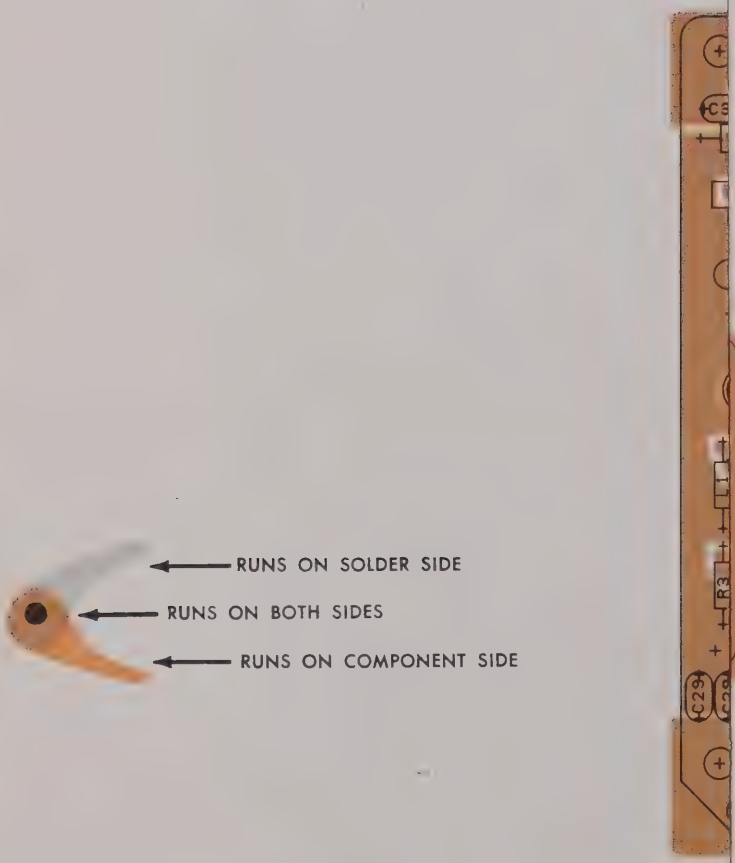
WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

POWER ADJUST CIRCUIT

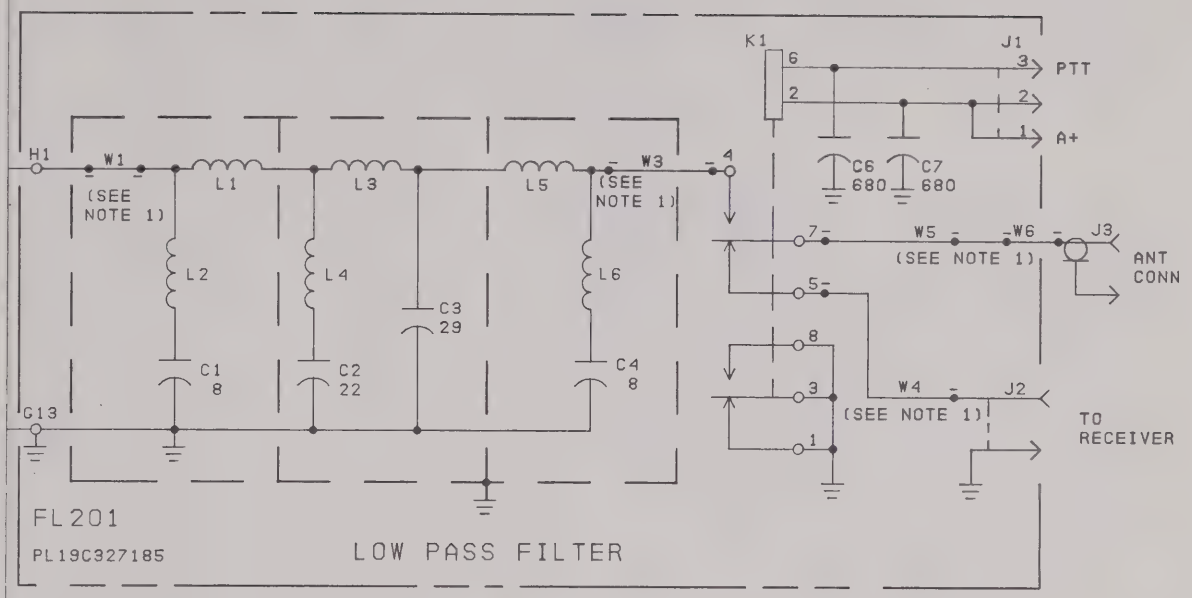
The power adjust circuit consists of R8 and Q215. R8 controls the base voltage and conduction of Q215. Q215 is connected in series with the collector feed network for Q1, thereby controlling the drive to Q2 and the output power. R8 is adjusted to provide the desired output power.





OUTLINE DIAGRAM

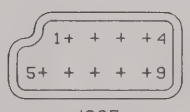
138—174 MHz, 10-WATT POWER AMPLIFIER



DULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
4309G2		PL19C327185G1		PL19D423927G2		138-174 MHZ

NOTES:
1. MICROSTRIP (PART OF PW BD)
2. INDICATES A-
   INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423927
4. PART OF PW BOARD
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



J205

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

VOLTAGE READINGS

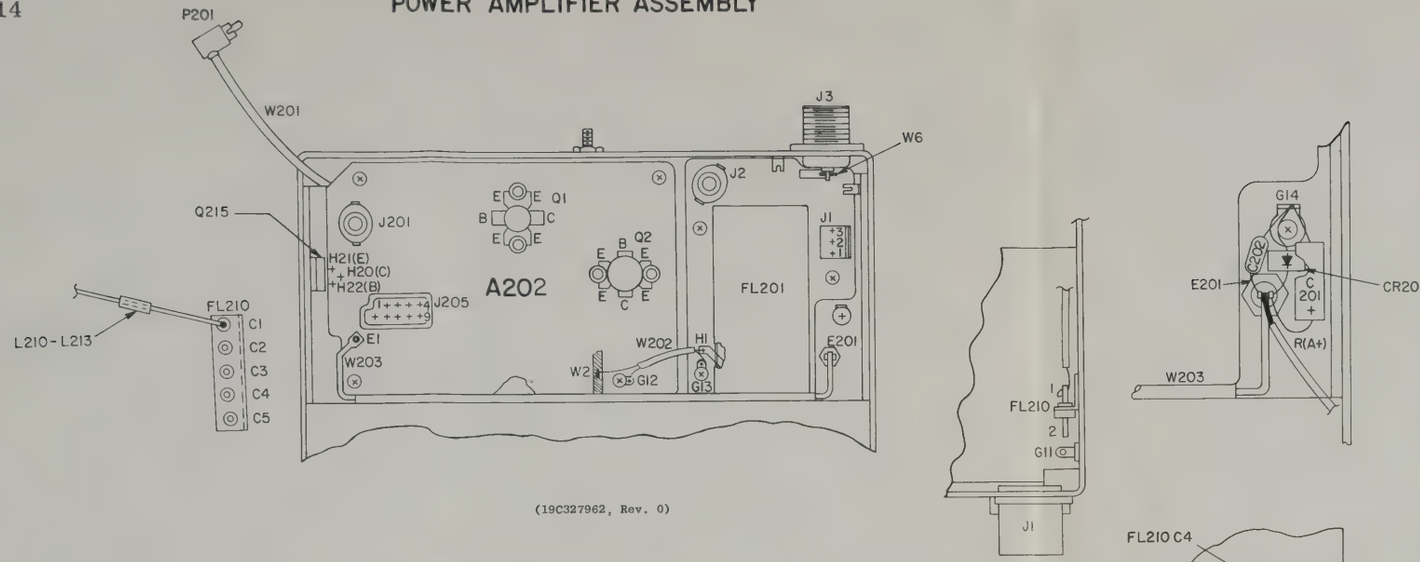
VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

SCHEMATIC DIAGRAM

138—174 MHz, 10-WATT POWER AMPLIFIER

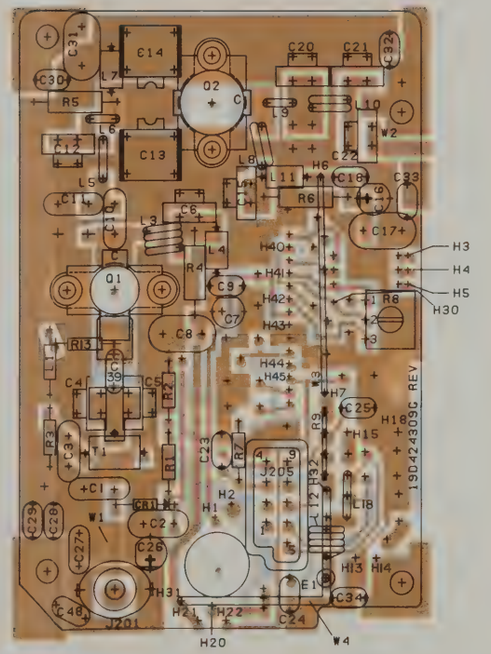
Issue 1

POWER AMPLIFIER ASSEMBLY



(19C327962, Rev. 0)

PA BOARD

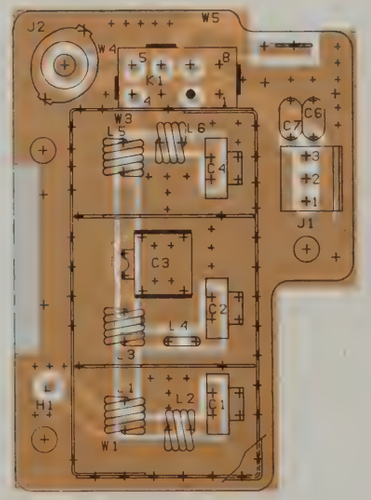


(19C327824, Rev. 0)
(19B227634, Sh. 1, Rev. 0)
(19B227634, Sh. 2, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

CONNECTIONS CHART			
FROM	TO	WIRE SIZE	REMARKS
H13	H14	DB	
H40	H45	DA	SLEEVE
H41	H43	DA	SLEEVE
H42	H44	DA	SLEEVE

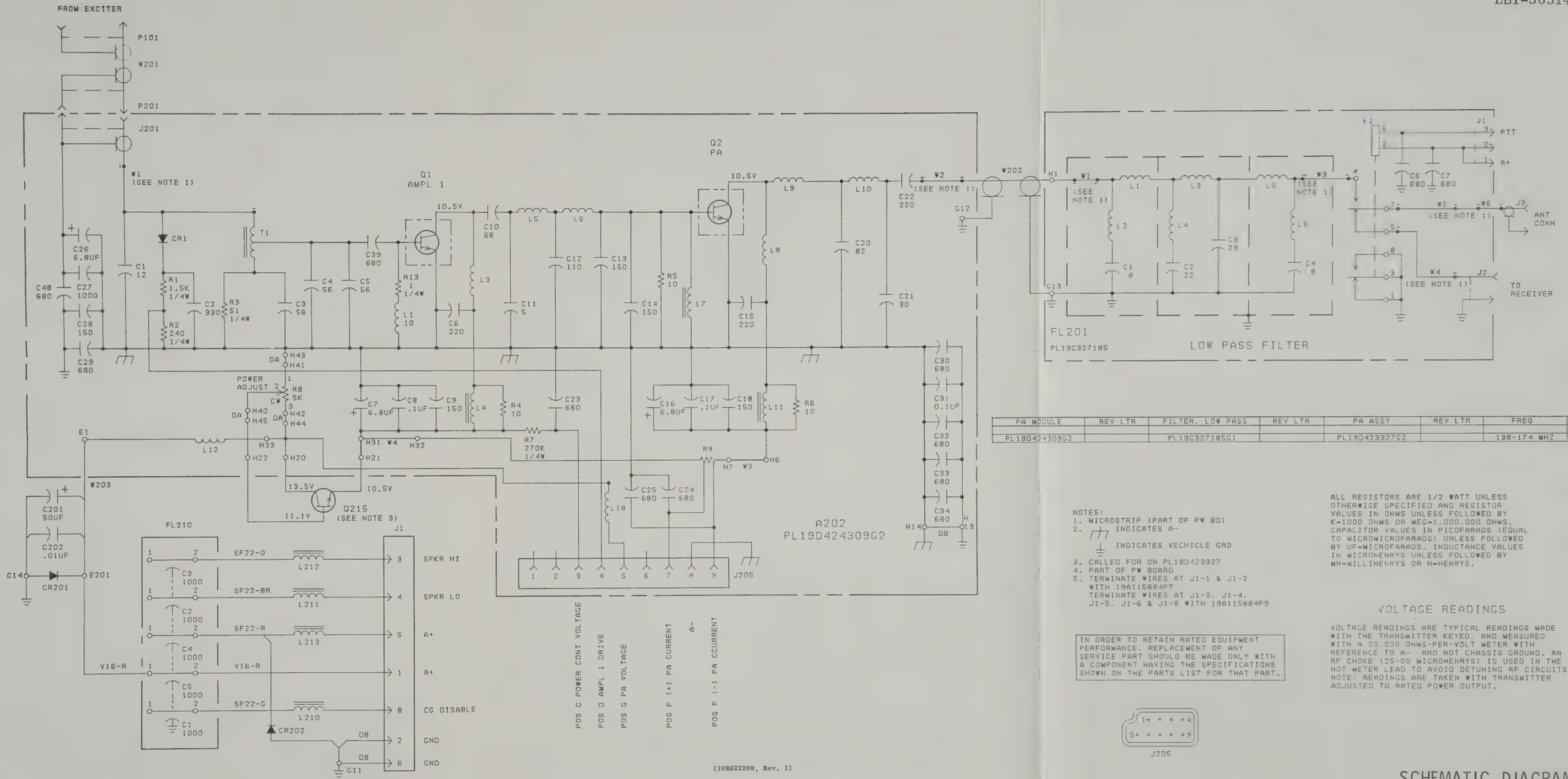
FILTER BOARD



(19C327186, Rev. 1)
(19B227410, Sh. 1, Rev. 1)
(19B227410, Sh. 2, Rev. 1)

OUTLINE DIAGRAM

138—174 MHz, 10-WATT POWER AMPLIFIER



(19R622298, Rev. 1)

PA MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
PL19D424309G2		PL19C327185G1		PL19D423927G2		138-174 MHZ

NOTES:
1. MICROSTRIP (PART OF PW BD)
2. ⏚ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423927
4. PART OF PW BOARD
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

SCHEMATIC DIAGRAM

138—174 MHz, 10-WATT POWER AMPLIFIER

PARTS LIST

LBI-30515

138-174 MHz, 10 WATT POWER AMPLIFIER
19D42392G2

SYMBOL	GE PART NO.	DESCRIPTION
A202		POWER AMPLIFIER MODULE 19D424308G2
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	7489162P7	Silver mica: 12 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C2	7489162P39	Silver mica: 330 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C3	7489162P21	Silver mica: 56 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C4 and C5	19A116679P56J	Metallized teflon: 56 pf ±5%, 250 VDCW.
C6	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C7	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C8	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C9	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	7489162P23	Silver mica: 68 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11	7489162P1	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C12	19A116679P110J	Silver mica: 110 pf ±5%, 250 VDCW.
C13 and C14	19A116952P150J	Silver mica: 150 pf ±5%, 250 VDCW; sim to Underwood Type J1HF.
C15	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C16	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C17	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C18	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	19A116679P82J	Mica: 82 pf ±5%, 250 VDCW.
C21	19A116679P30J	Metallized teflon: 30 pf ±5%, 250 VDCW.
C22	19A116679P220J	Silver mica: 220 pf ±5%, 250 VDCW.
C23 thru C25	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C26	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C27	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C28	19A116655P8	Ceramic disc: 150 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C29 and C30	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C31	19A116080P107	Polyester: 0.1 µf ±10%, 50 VDCW.
C32 thru C34	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C36	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C48	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - -
E1	19A134263P1	Contact, electrical: sim to Selectro 229-1082-00-0-590.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J201	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
J205	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19B209420P125	Coil, RF: 10.0 µh ±10%, 3.10 ohms DC res max; sim to Jeffers 4446-4K.
L3	19A136530P1	Coil.
L4	19A129773G1	Coil.
L5	19A136532P2	Coil.
L6	19A129575P1	Coil.
L7	19A129773G1	Coil.
L8	19A136531P1	Coil.
L9	19A136907P2	Coil.
L10	19A129561P1	Coil.
L11	19A129773G1	Coil.
L12	19A129569P1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A134340P1	Silicon, NPN.
Q2	19A134340P3	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - -
R1	3R152P152J	Composition: 1500 ohms ±5%, 1/4 w.
R2	3R152P241J	Composition: 240 ohms ±5%, 1/4 w.
R3	3R152P510J	Composition: 51 ohms ±5%, 1/4 w.
R4 thru R6	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R7	3R152P274J	Composition: 270,000 ohms ±5%, 1/4 w.
R8	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R9	19C320212P2	Shunt resistor.
R13	19A116216P1ROK	Deposited carbon: 1.0 ohms ±10%, 1/4 w; sim to Amperex Type 8803104 Style CR25.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T1	19A129564G1	Transformer.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 and W2		(Part of printed board 19D424308P1)
W3	19B227912P1	Jumper.
W4	19B227912P2	Jumper.
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal, standoff.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL201		LOW PASS FILTER 19C327185G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C2	19A116679P22J	Metallized teflon: 22 pf ±5%, 250 VDCW.
C3	19A116795P29J	Metallized teflon: 29 pf ±5%, 250 VDCW; sim to Underwood Type J1HF.
C4	19A116679P8D	Metallized teflon: 8 pf ±.5 pf, 250 VDCW.
C6 and C7	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L1	19A129569P1	Coil.
L2	19A129570P1	Coil.
L3	19A129569P1	Coil.
L4	19A129575P1	Coil.
L5	19A129569P1	Coil.
L6	19A129570P1	Coil.
		- - - - - - - JACKS AND RECEPTACLE - - - - - -
J1	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180-330 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		(Part of printed board 19C327184P1).
W3 thru W5		(Part of printed board 19C327184P1).
W6	19A136512P1	Antenna strap.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER ASSEMBLY 19A136868G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FASC.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
G11 thru G14	7135118P2	Terminal, solderless.
		- - - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1.
	19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1.
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-79S.
		- - - - - - - - - - INDUCTORS - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P201		(Part of W201).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q201	19A134340P1	Silicon, NPN.
Q202	19A134340P2	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P91	Cable, RF: approx 7-1/2 inches long.
W202	19A136529G2	Cable: approx 2 inches long.
W203	19B227302P1	Jumper.
		- - - - - - - - - MISCELLANEOUS - - - - - - - -
	19C321982P1	Insulator. (Located under A201).
	19B209209P304	Tap screw, Phillips Pozidriv : No. 6-32 x 1/4. (Secures FL210).
	4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL201).
	N44P9006C6	Screw, machine: No. 4-40 x 3/8. (Secures Q201 and Q202).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	19B201074P204	Tap screw, Phillips POZIDRIV : No. 4-40 x 1/4. (Secures J3).
	7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	4035306P40	Washer, fiber. (Used with C5 on FL210).
	19A116417P4	Plastic bumper. (Quantity 3).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

GE PART NO.	DESCRIPTION
	- - - - - - - - - - - CABLES - - - - - - - - - - -
5491689P91	Cable, RF: approx 7-1/2 inches long.
19A136529G2	Cable: approx 2 inches long.
19B227302P1	Jumper.
	- - - - - - - - - MISCELLANEOUS - - - - - - - - -
19C321982P1	Insulator. (Located under A201).
19B209209P304	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/4. (Secures FL210).
4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL201).
N44P9006C6	Screw, machine: No. 4-40 x 3/8. (Secures Q201 and Q202).
19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
19A134016P1	Insulator, bushing. (Used with Q215).
19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
4035306P40	Washer, fiber. (Used with C5 on FL210).
19A116417P4	Plastic bumper. (Quantity 3).

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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MOBILE RADIO

MAINTENANCE MANUAL

406—512 MHz POWER AMPLIFIER BOARD 19D423928G5, G6, G8

TABLE OF CONTENTS

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DESCRIPTION	1
CIRCUIT ANALYSIS	1
OUTLINE DIAGRAM	2
SCHEMATIC DIAGRAM	3
PARTS LIST AND PRODUCTION CHANGES	4

DESCRIPTION

The PA assembly for CUSTOM MVP transmitters uses four RF power transistors to provide a power output of 35 Watts. The output power is adjustable using power control R213 and is type accepted with the FCC to operate over a range of 1-Watt to rated output power. A single transistor is used in the power control circuit.

Supply voltage (A+) for the PA is connected from J1 on the back of the radio through FL210-C5 on the side of the radio. C201, C202, and C203 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J5 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power adjust voltage, driver, and PA current.

CIRCUIT ANALYSIS

RF POWER AMPLIFIERS

The exciter output is coupled through RF cable W201 to PA input jack J1. The 50 ohms RF input is coupled through a matching network comprised of C6, C7, C8 and W2 to the base of power amplifier Q1.

Part of the RF input is rectified by CR1 and metered at J5-4 through resistor R1.

Collector voltage for Q1 is applied direct from the DC power input through collector stabilizing network R5 and L2 and collector feed network L3 and C10.

The output of Q1 is coupled to the base of a second power amplifier Q202 through a matching network consisting of T1, C15 and C16.

Collector voltage to Q202 is controlled by power control circuit, Q215, and is applied through a collector stabilizing network L6 and R6 and collector feed network L5 and C18.

The output of Q202 is coupled to the base of driver Q203 through C17, C19 and a matching network consisting of T2, C22, C52, C24 and C25. The collector voltage to Q203 is coupled through collector stabilizing network L9 and R14 and collector feed network L8 and C26.

Collector current for Q203 is metered across tapped manganin resistor R12. The reading is taken in position F on the 1-Volt scale with the High Sensitivity button pressed, and read as 0-15 amperes full scale.

The output of driver Q203 is coupled through an impedance matching network (C26, C27, C29, C30, C33 and T3) that matches the output impedance of Q203 to the input impedance of power amplifier Q204 through a 50 ohm micro strip (W204) and input impedance matching network T4, C34, C35 and C36.

Collector current for Q204 is metered across tapped manganin resistor R10. The reading is taken in position G on the 1-Volt scale with the High Sensitivity button pressed and read as 0-15 amperes full scale.

Following power amplifier Q204 is a matching network C37, C38, and T5 that matches the output of Q204 to the 50-ohm input of low pass filter, through 50 ohm micro strip W5 and a 50 ohm cable W214. C1 on the low pass filter board provides DC isolation between the transmitter and the antenna.

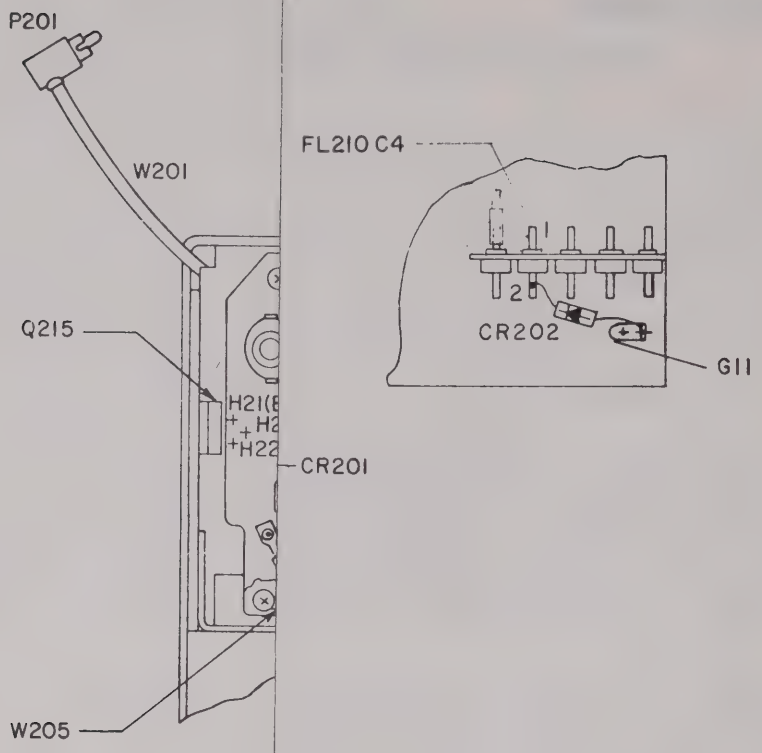
The PA output is coupled through the low-pass filter to the antenna through antenna transfer relay K1.

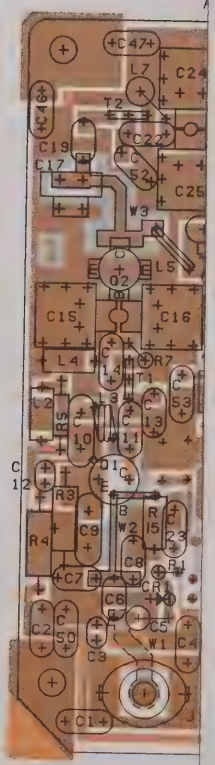
WARNING

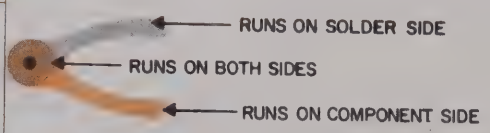
The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

POWER CONTROL CIRCUIT

The power control circuit consists of R13 and Q215. R13 controls the base voltage, and conduction of Q215. Q215 is connected in series with the collector feed network for Q202 thereby controlling the drive to Q203 and therefore the output power. R13 is adjusted to provide the desired output power. The control voltage for Q202 is measured in position C on 1 volt scale and read as 0-15 volts full scale.







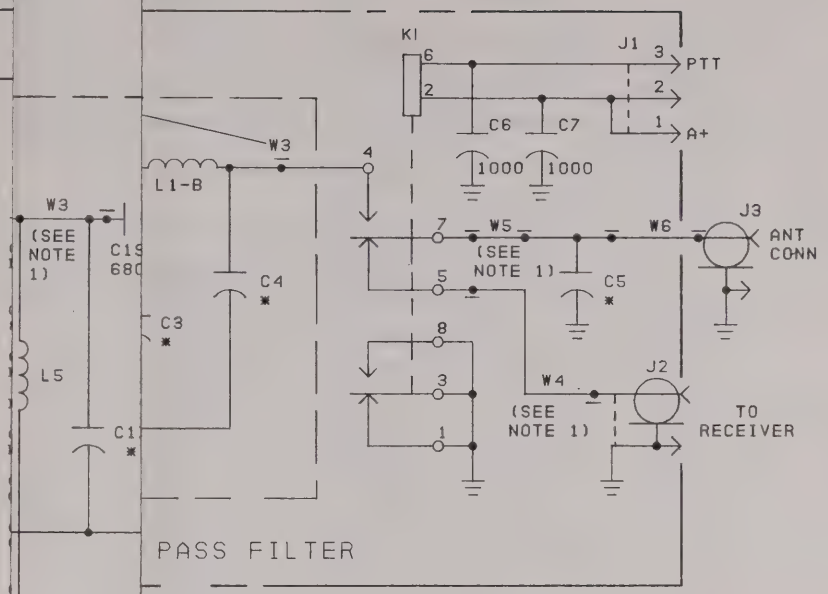
OUTLINE DIAGRAM

406—512 MHz, 35-WATT
POWER AMPLIFIER

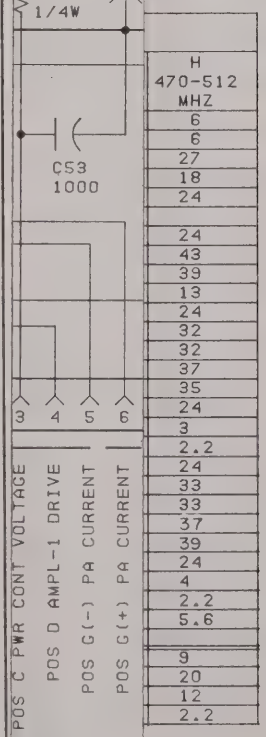
406-512 MH
19D4
19D4
19D4

SYMBOL	GE PART NO.
A205, A206, A208	
C201 and C202	19A116655P20
C203	19A116192P1
C204	19A116655P20
C205	5491601P113
C206	19A116655P18
C207LL	19A116656P8J0
C207L and C207H	19A116656P6J0
C208LL	19A116656P8J0
C208L and C208H	19A116656P6J0
C209LL	7489162P15
C209L	7489162P11
C209H	7489162P13
C210LL	7489162P13
C210L and C210H	7489162P9
C211LL	19A116656P33J0 0 PPM.
C211L and C211H	19A116656P24J0
C212	19A116192P1
C213	19A116656P4J0 0 PPM.
C214LL	19A116656P33J0
C214L and C214H	19A116656P24J0
C215LL and C215L	19A116952P47
C215H	19A116952P43
C216LL	19A116952P51
C216L	19A116952P43
C216H	19A116952P39
C217LL	19A116679P18D
C217L	19A116679P16D
C217H	19A116679P13D

*COMPONENTS ADDED, DEL



LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
321963G1		PL19D423928G5		406-450 MHZ
321963G2		PL19D423928G6		450-470 MHZ
321963G2		PL19D423928G8		470-512 MHZ



H 470-512 MHZ
6
6
27
18
24
24
43
39
13
24
32
32
37
35
24
3
2.2
24
33
33
37
39
24
4
2.2
5.6
9
20
12
2.2

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⊓⊓⊓ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9.
6. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN ON BOARD 19C321723. FOR COMPLETE DESIGNATION PREFIX WITH 200 SERIES; EXAMPLE C1-C201, R1-R201, ETC.

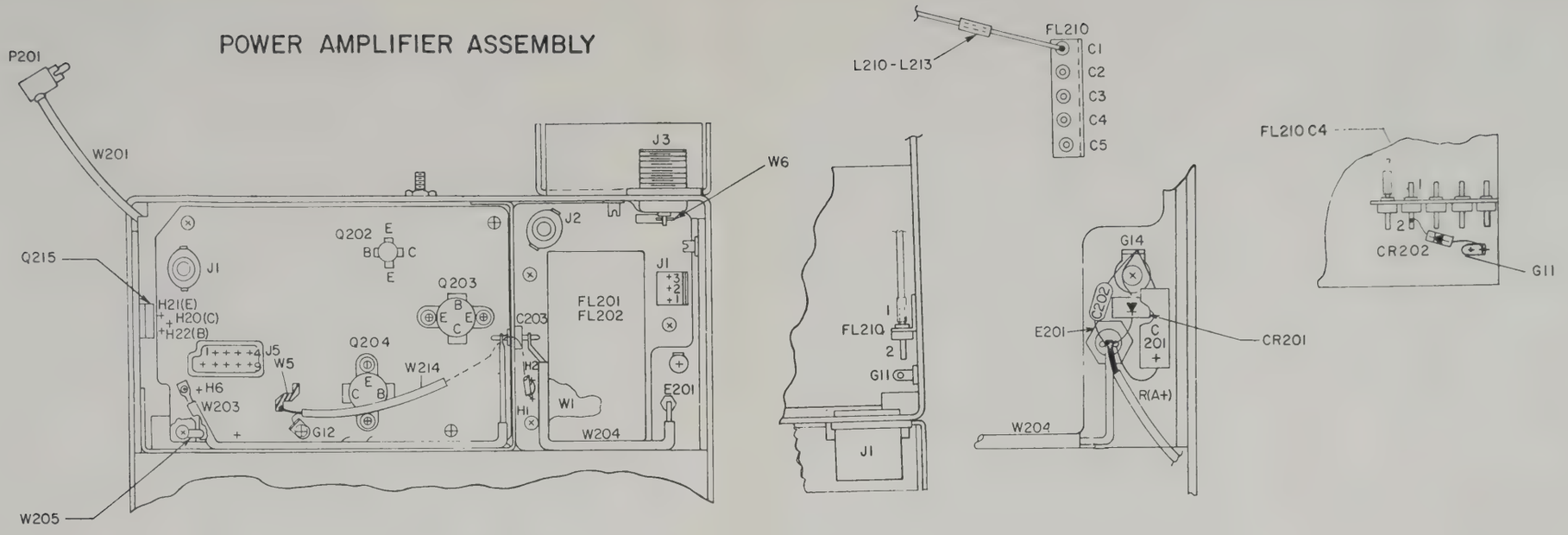
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

SCHEMATIC DIAGRAM

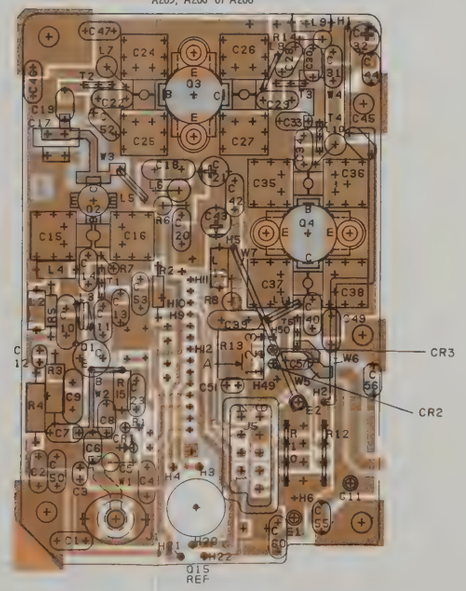
406—512 MHz, 35-WATT POWER AMPLIFIER

POWER AMPLIFIER ASSEMBLY



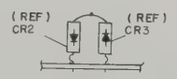
(19C327852, Rev. 1)

A205, A206 or A208



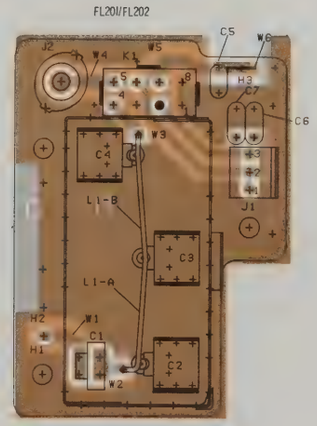
(19C327156, Rev. 4)
(19B226633, Sh. 2, Rev. 1)
(19B226633, Sh. 3, Rev. 1)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH 200 SERIES. EXAMPLE: C1-C201, R1-R201, ETC.



VIEW "A"
ROTATED 90° CCW

FL201/FL202



(19C327137, Rev. 2)
(19B227225, Sh. 2, Rev. 0)
(19B227225, Sh. 3, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

406—512 MHz, 35-WATT
POWER AMPLIFIER

PARTS LIST

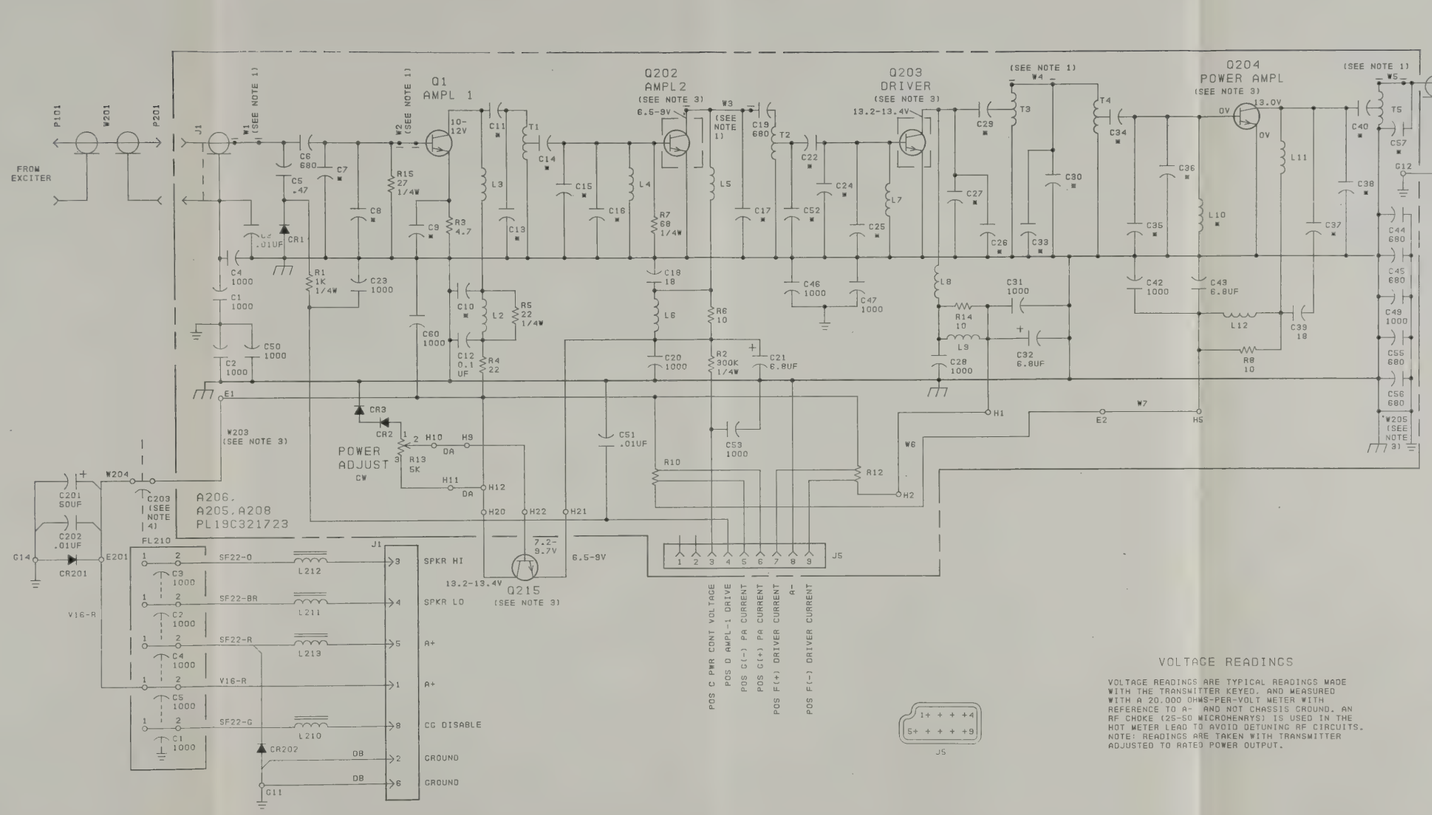
LBI30585A

406-512 MHz 35 WATT POWER AMPLIFIER
19D423923G3 406-450 MHz
19D423928G6 450-470 MHz
19D423928G8 470-512 MHz

SYMBOL	GE PART NO.	DESCRIPTION
A205 A206 A208		POWER AMPLIFIER MODULE A205 19C321723G5 406-450 MHz A206 19C321723G6 450-470 MHz A208 19C321723G8 470-512 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201 and C202	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C203	19A116192P1	Ceramic: 0.01 pf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C204	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C205	5491601P113	Phenolic: 0.47 pf ±5%, 500 VDCW.
C206	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C207LL	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C207L and C207M	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C208LL	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C208L and C208M	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C209LL	7489162P15	Silver mica: 33 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C209L	7489162P11	Silver mica: 22 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C209M	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C210LL	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C210L and C210M	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type IM-15.
C211LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C211L and C211M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C212	19A116192P1	Ceramic: 0.01 pf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C213	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C214LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C214L and C214M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C215LL and C215L	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW.
C215M	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C216LL	19A116952P51	Metallized teflon: 51 pf ±2%, 250 VDCW.
C216L	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C216M	19A116952P39	Metallized teflon: 39 pf ±2%, 250 VDCW.
C217LL	19A116679P18D	Metallized teflon: 18 pf ±.5 pf, 250 VDCW.
C217L	19A116679P16D	Metallized teflon: 16 pf ±.5 pf, 250 VDCW.
C217M	19A116679P13D	Metallized teflon: 13 pf ±.5 pf, 250 VDCW.

(Cont'd on Page 4)

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENARYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

PA MODULE	REV LTR	FILTER LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
PL19C321723G5	E	PL19C321963G1		PL19D423923G5		406-450 MHZ
PL19C321723G6	E	PL19C321963G2		PL19D423928G6		450-470 MHZ
PL19C321723G8	E	PL19C321963G2		PL19D423928G8		470-512 MHZ

■ COMPONENT VALUE AS FOLLOWS:

	COMP IDENT	LL 406-450 MHZ	L 450-470 MHZ	H 470-512 MHZ
A205 OR A208	C7	8	6	6
	C8	8	6	6
	C9	33	22	27
	C10	27	18	18
	C11	33	24	24
	C13	4		
	C14	33	24	24
	C15	47	47	43
	C16	51	43	39
	C17	18	16	13
	C22	33	24	24
	C24	41	35	32
	C25	43	35	32
	C26	47	43	37
	C27	43	37	35
	C29	33	24	24
	C30	6	4	3
	C33			2.2
	C34	33	24	24
	C35	43	37	33
	C36	39	35	32
	C37	51	47	37
	C38	51	47	39
	C40	33	24	24
	C52	5	4	4
	C57	6		2.2
	L10	15	5.6	5.6
FL201 OR FL202	C2	10	8	8
	C3	22	20	20
	C4	13	12	12
	C5		2.2	

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⏚ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7. TERMINATE WIRES AT J1-3. J1-4. J1-5. J1-6 & J1-8 WITH 19A115884P9.
6. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN ON BOARD 19C321723. FOR COMPLETE DESIGNATION PREFIX WITH 200 SERIES; EXAMPLE C1=C201, R1=R201, ETC.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

(19A822308, Rev. 4)

SCHEMATIC DIAGRAM

406—512 MHz, 35-WATT POWER AMPLIFIER

(LBI30585 Cont'd from Page 3)

SYMBOL	GE PART NO.	DESCRIPTION
C218	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C219	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C220	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C221	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C222LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C222L and C222M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C223	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C224LL	19A116952P41	Metallized teflon: 41 pf ±2%, 250 VDCW.
C224L	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW.
C224M	19A116952P32	Metallized teflon: 32 pf ±2%, 250 VDCW.
C225LL	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C225L	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW.
C225M	19A116952P32	Metallized teflon: 32 pf ±2%, 250 VDCW.
C226LL	19A116952P47	Metallized teflon: 47 pf ±2% 250 VDCW.
C226L	19A116952P43	Metallized teflon: 43 pf ±2% 250 VDCW.
C226M	19A116952P37	Metallized teflon: 37 pf ±2%, 250 VDCW.
C227LL	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C227L	19A116952P37	Metallized teflon: 37 pf ±2%, 250 VDCW.
C227M	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW.
C228	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C229LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C229L and C229M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C230LL	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C230L	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C230M	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C231	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C232	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C233M	19A134100P20	Ceramic disc: 2.2 pf ±0.1 pf, 100 VDCW, temp coef 0 ±120PPM °C.
C234LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C234L and C234M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C235LL	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C235L	19A116952P37	Metallized teflon: 37 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C235M	19A116952P33	Metallized teflon: 33 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C236LL	19A116952P39	Metallized teflon: 39 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C236L	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C236M	19A116952P33	Metallized teflon: 33 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C237LL*	19A116952P51	Metallized teflon: 51 pf ±2%, 250 VDCW; sim to Underwood Type J18F. In REV D and earlier:
	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C237L	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C237M*	19A116952P37	Metallized teflon: 37 pf ±2%, 250 VDCW; sim to Underwood Type J18F. In REV D and earlier:
	19A116952P33	Metallized teflon: 33 pf ±2%, 250 VDCW; sim to Underwood Type J18F.

SYMBOL	GE PART NO.	DESCRIPTION
C238LL*	19A116952P51	Metallized teflon: 51 pf ±2%, 250 VDCW; sim to Underwood Type J18F. In REV D and earlier:
	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C238L	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C238M*	19A116952P39	Metallized teflon: 39 pf ±2%, 250 VDCW; sim to Underwood Type J18F. In REV D and earlier:
	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW; sim to Underwood Type J18F.
C239	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C240LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C240L and C240M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C242	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C243	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C244 and C245	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C246 and C247	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C249 and C250	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C251	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 S9SCIAL.
C252LL	19A116656P6J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C252L and C252M	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C253	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C255 and C256	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C257LL	19A116656P6J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C257M	19A134100P20	Ceramic disc: 2.2 pf ±0.1 pf, 100 VDCW.
C260	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
- - - - - - - - DIODES AND RECEPTACLES - - - - - -		
CR201	19A116052P1	Diode, silicon.
CR202 and CR203	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
- - - - - - - - - TERMINALS - - - - - - - - -		
E1 and E2	19A134263P1	Contact, electrical; sim to Selectro X-L-070174-1.
G11	19A134263P1	Contact, electrical; sim to Selectro X-L-070174-1.
- - - - - - - JACKS AND RECEPTACLES - - - - - -		
J201	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14B11613.
J205	19B219374G1	Connector: 9 contacts.
- - - - - - - - - - INDUCTORS - - - - - - - - - -		
L202	19A129773G1	Coil.
L203	19A129774P1	Coil.
L204	19A129773G1	Coil.
L205	19B219457P6	Coil.
L206	7488079P40	Choke, RF: 5.60 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4422-1K.
L207	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4K.
L208LL	19B219457P6	Coil.

SYMBOL	GE PART NO.	DESCRIPTION
L208L and L208M	19A130650P1	Coil.
L209	19A129773G1	Coil.
L210LL	7488079P18	Choke, RF: 15.0 µh ±10%, 1.20 ohms DC res max; sim to Jeffers 4421-9K.
L210L and L210M	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4K.
L211	19B219457P6	Coil.
L212	19A129773G1	Coil.
- - - - - - - - - - TRANSISTORS - - - - - - - - - -		
Q201	19A134237P1	Silicon, NPN.
- - - - - - - - - - RESISTORS - - - - - - - - - -		
R201	3R151P102J	Composition: 1K ohms ±5%, 1/8 w.
R202	3R152P304J	Composition: 300K ohms ±5%, 1/4 w.
R203	7147161P13	Composition: 4.7 ohms ±5%, 1/2 w.
R204	3R77P220J	Composition: 22 ohms ±5%, 1/2 w.
R205	3R152P220J	Composition: 22 ohms ±5%, 1/4 w.
R206	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R207	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R208	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R210	19C320212P1	Shunt resistor.
R212	19C320212P1	Shunt resistor.
R213	19A116559P102	Variable, cermet: 5K ohms ±20%, .5 w; sim to CTS Series 360.
R214	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R215	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
- - - - - - - - - - TRANSFORMERS - - - - - - - - - -		
T201 thru T205	19A130446G1	Coil.
- - - - - - - - - - CABLES - - - - - - - - - -		
W201 thru W204		(Part of printed board 19D423005P1).
W205	19B226971G1	Jumper.
W207	19A130791G1	Jumper.
- - - - - - - - - - CAPACITORS - - - - - - - - - -		
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Wallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C203	19B209488P2	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Style FA5D.
- - - - - - - DIODES AND RECTIFIERS - - - - - -		
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon, 1000 mA, 400 PIV.
- - - - - - - - - - TERMINALS - - - - - - - - - -		
E201	7143208P1	Terminal, standoff.
- - - - - - - - - - FILTERS - - - - - - - - - -		
FL201 and FL202		FILTER BOARD FL201 19C321963G1 406-450 MHz (LL) FL202 19C321963G2 450-512 MHz (H)
- - - - - - - - - - CAPACITORS - - - - - - - - - -		
C1	19A116679P240J	Silver mica: 240 pf ±5%, 250 VDCW.
C2LL	19A116952P10	Metallized teflon: 10 pf ±0.5 pf, 250 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C2H	19A116952P9	Metallized teflon: 9 pf ±0.5 pf, 250 VDCW.
C3LL	19A116952P22	Metallized teflon: 22 pf ±0.5 pf, 250 VDCW.
C3H	19A116952P20	Metallized teflon: 20 pf ±0.5 pf, 250 VDCW.
C4LL	19A116952P13	Metallized teflon: 13 pf ±0.5 pf, 250 VDCW.
C4H	19A116952P12	Metallized teflon: 12 pf ±0.5 pf, 250 VDCW.
C5H	19A134100P20	Ceramic: 2.2 pf ±0.1 pf, 100 VDCW.
C6 and C7	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
- - - - - - - JACKS AND RECEPTACLES - - - - - -		
J1	19A116559P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14B11613.
- - - - - - - - - - RELAYS - - - - - - - - - -		
K1	19B209558P1	Hermetic sealed: 180 to 330 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 38AV1760A2.
- - - - - - - - - - INDUCTORS - - - - - - - - - -		
L1LL	19B227240P1	Jumper.
L1H	19B227240P2	Jumper.
- - - - - - - - - - CABLES - - - - - - - - - -		
W1 thru W5		(Part of printed board 19C321962P1).
W6	19A136512P1	Antenna strap.
- - - - - - - - - - FILTERS - - - - - - - - - -		
FL210		FILTER 19A136680G1
- - - - - - - - - - CAPACITORS - - - - - - - - - -		
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW. sim to Allen-Bradley Type FA5C.
- - - - - - - - - - TERMINALS - - - - - - - - - -		
G11 and G12	7135118P2	Terminal, solderless.
G14	7135118P2	Terminal, solderless.
- - - - - - - JACKS AND RECEPTACLES - - - - - -		
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1.
	19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1.
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-79S.
- - - - - - - - - - INDUCTORS - - - - - - - - - -		
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
- - - - - - - - - - PLUGS - - - - - - - - - -		
P201		(Part of W201).
- - - - - - - - - - TRANSISTORS - - - - - - - - - -		
Q202	19A134164P2	Silicon, NPN: sim to Type 2N5945.
Q203C	19A134171P2	Silicon, NPN. (406-450 MHz)
Q203D	19A134239P1	Silicon, NPN. (450-512 MHz)

SYMBOL	GE PART NO.	DESCRIPTION
Q204	19A134242P1	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
- - - - - - - - - - CABLES - - - - - - - - - -		
W201	5491689P91	Cable, RF: approx 7-1/2 inches long.
W203	19C327146P1	Jumper.
W204	19C327146P2	Jumper.
W205	7135118P1	Terminal, solder.
W214	19A130831G2	Cable: approx 5-1/4 inches long.
- - - - - - - - MISCELLANEOUS - - - - - - - -		
	19C321441P1	Insulator. (Located under A205 and A206, A208).
	19B227353G1	Shield. (Located around A205, A206, A208).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures shield to frame at C17).
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16. (Secures shield to frame at J5).
	5492178P2	Washer, spring tension. (Used with Q202).
	N207P15C6	Hex nut: No. 8-32. (Used with Q202).
	19A130465P1	Spacer. (Used with Q202).
	N44P6006C6	Screw, machine: No. 4-40 x 3/8. (Secures Q203).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL201 and FL202).
	N84P13003C6	Tap screw, Phillips Pozidriv®: No. 6-32 x 3/16. (Secures FL210).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	4036555P1	Insulator, washer: nylon. (Used with Q201 on PA Module).
	19B219554G2	Can. (FL201, FL202).
	19B219555P1	Cover. (FL201, FL202).
	19B209502P1	Terminal, stud. (Used with C2, C3, C4, L1).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - D - Power Amplifier Module 19C321723G5, 6, 8
Incorporated in initial shipment.

REV. E - Power Amplifier Module 19C321723G5
Increase Power output. Changed C237LL and C238LL.

REV. L - Power Amplifier Module 19C321723G8
Increase Power output. Changed C237M and C238M.

DESCRIPTION

- - - CABLES - - - - - - - - - -

ox 7-1/2 inches long.

1/4 inches long.

MISCELLANEOUS - - - - - - - -

ted under A205 and A206, A208).

around A205, A206, A208).

ps POZIDRIV®: No. 6-32 x 1/4.
o frame at C17).

ps POZIDRIV®: No. 6-32 x 5/16.
o frame at J5).

nsion. (Used with Q202).

2. (Used with Q202).

th Q202).

No. 4-40 x 3/8. (Secures Q203).

Dupont No. 300 Kapton H.
15).

g. (Used with Q215).

2. (Secures stud that mates
uring radio to case).

ess: sim to Zierick 349.
and FL202).

ps Pozidriv®: No. 6-32 x 3/16.

ps POZIDRIV®: No. 4-40 x 1/4.

nylon. (Used with Q201 on

02).

L202).

(Used with C2, C3, C4, L1).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - D - Power Amplifier Module 19C321723G5, 6, 8

REV. E - Power Amplifier Module 19C321723G6
Incorporated in initial shipment.

REV. E - Power Amplifier Module 19C321723G5
Increase Power output. Changed C237LL and C238LL.

REV. E - Power Amplifier Module 19C321723G8
Increase Power output. Changed C237H and C238H.

MAINTENANCE MANUAL

66—88 MHz, 25-WATT POWER AMPLIFIER ASSEMBLY I9D429074G1-3

TABLE OF CONTENTS

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DESCRIPTION	1
CIRCUIT ANALYSIS	1
OUTLINE DIAGRAM	2
SCHEMATIC DIAGRAM	3
PARTS LIST AND PRODUCTION CHANGES	4

DESCRIPTION

The 66-88 MHz PA assembly for CUSTOM MVP radios uses two RF power transistors to provide a power output of 25 watts. The output power is adjustable using power adjust control R3 over a range of 8 to 25 watts. A single transistor is used in the power adjust circuit.

Supply voltage for the PA is connected through power leads from the system board to feed through capacitors C201 and C202 on the side of the PA assembly. C201 and C202 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J205 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power control voltage (Ampl-1 collector voltage) and PA current.

CIRCUIT ANALYSIS

RF AMPLIFIERS

The exciter output is coupled through a 50-ohm cable to PA input jack J201. The RF is coupled through DC blocking capacitor C1 and an impedance matching network to the base of Class C amplifier Q1. The network matches the 50-ohm input to the base of Q1 and consists of C2, C3, C4, L1 and L2. L3 and R1 comprise a stabilizing network in the base circuit of Q1.

Part of the RF input is rectified by CR1 and applied to voltage divider R7 and R8. This voltage is used to meter the AMPL-1 drive at J205-4.

Collector voltage to Q1 (Ampl-1) is controlled by the power adjust circuit, Q215 and R3 and is applied through collector stabilizing network (L5 and R2 and collector feed network L4 and C7). The collector voltage of Q1 is metered through R9 at J205-3.

The output of Q1 is coupled to the base of Class C Power Amplifier, Q2 through coupling capacitor C10 and a matching network consisting of L6, C11, C12, and C13. L8 and R4 comprise a stabilizing network in the base circuit of Q2.

Collector current for Q2 is metered across tapped manganin resistor R6 at J205-5, 6 (PA Current). The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 10 amperes full scale.

Following Q2 is a matching network (L11, C17, C18 and L12) that matches the output of Q2 to the 50-ohm microstrip impedance (W2) to the input of low pass filter. When the transmitter is keyed, the PA output is coupled through the low-pass filter antenna transfer relay K1 to the antenna.

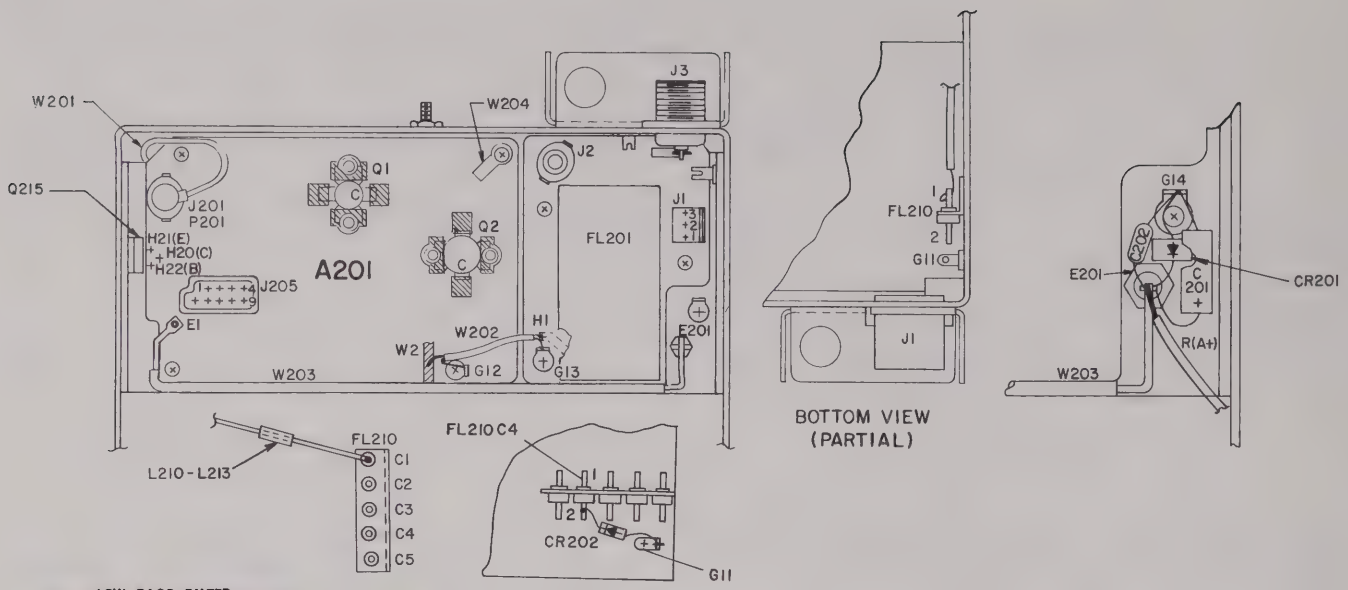
WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors.

POWER ADJUST CIRCUIT

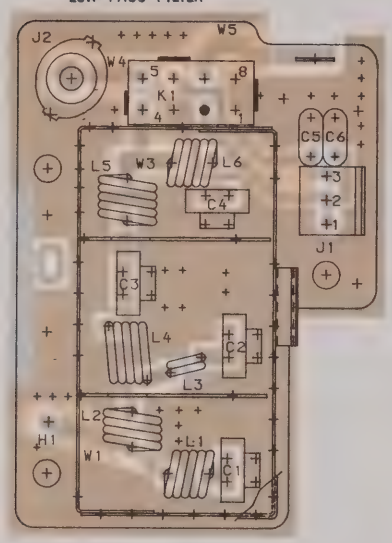
The power adjust circuit consists of R3 and Q215. R3 controls the base voltage and therefore the conduction of Q215. Q215 is connected in series with the collector feed network for Q1 thereby controlling the drive to PA transistor Q2 and the output power. R3 is adjusted to provide the desired output power over a range of 8 to 25 watts.

POWER AMPLIFIER ASSEMBLY



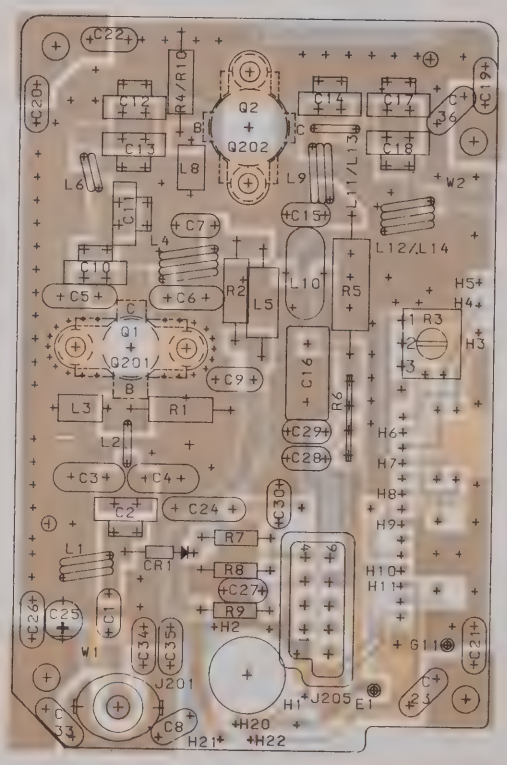
(19C328244, Rev. 0)

LOW PASS FILTER



(19C327954, Rev. 1)
(19B227596, Sh. 1, Rev. 0)
(19B227596, Sh. 2, Rev. 0)

PA BOARD



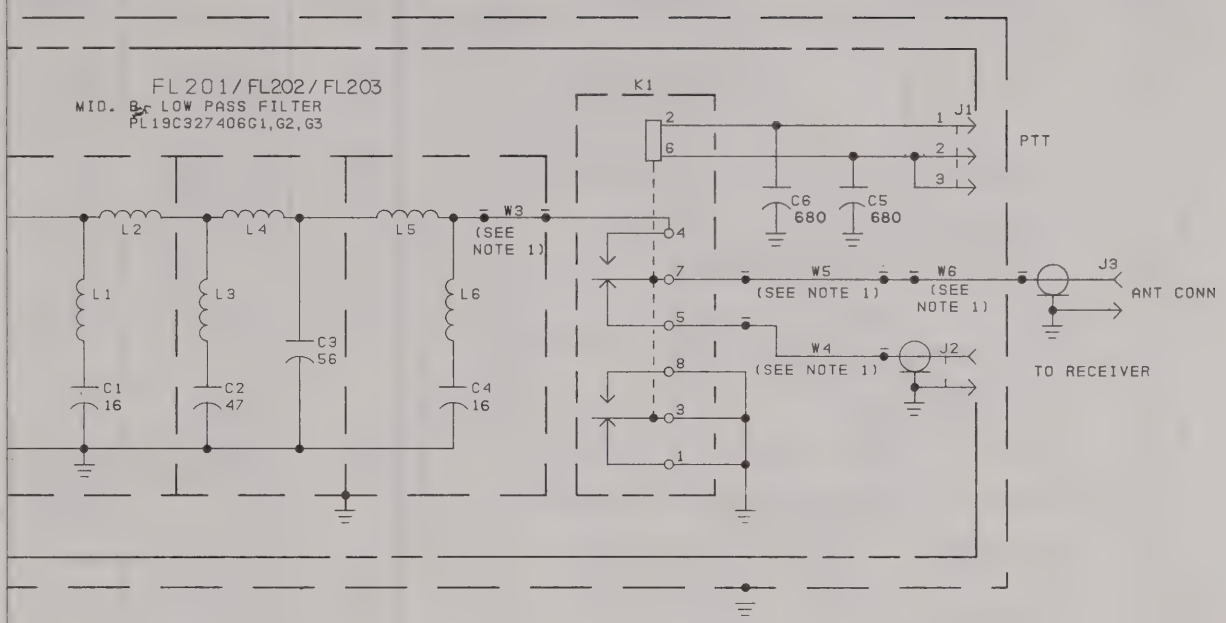
CONNECTION CHART			
FROM	TO	WIRE	REMARKS
H10	H8	DA	SLEEVE
H11	H6	DA	SLEEVE
H7	H9	DA	SLEEVE

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

(19C327844, Rev. 2)
(19B227591, Sh. 1, Rev. 1)
(19B227591, Sh. 2, Rev. 1)

OUTLINE DIAGRAM

66—88 MHz POWER AMPLIFIER



NOTE:
1. MICROSTRIP PART OF PWB.
2. CALLED FOR ON PL19D429074
3. PART OF PWB.
4. ⏚ INDICATES A-

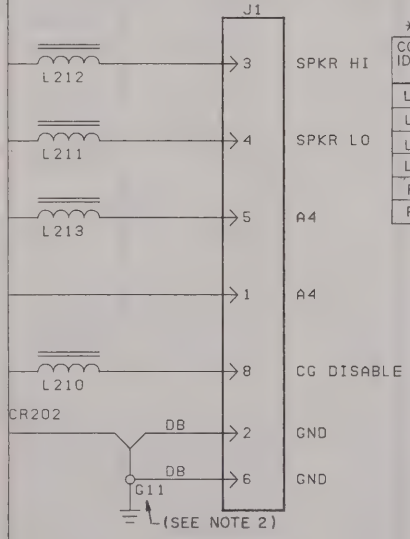
⏚ INDICATES VEHICLE GROUND.

5. TERMINATE WIRE AT J1-1 WITH 19A115887P7. TERMINATE WIRES AT J1-2, J1-3, J1-4, J1-5, J1-6 AND J1-8 WITH 19A115887P9.

6. TERMINATE WITH A4029840P5.

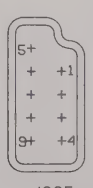
ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

VLTR	25W MID BAND PA	REV LTR	FILTER-LOW PASS	REV LTR
	19D429074G1		19C327406G1	
	19D429074G2		19C327406G2	
	19D429074G3		19C327406G3	



* COMPONENT IDENTIFICATION CHART

COMP IDENT	L 66-78 MHZ	H 77-88 MHZ	W 66-88 MHZ
L11		19B227869P11	19B227869P11
L12	19B227869P12		19B227869P12
L13	19B219457P7		
L14		19B227869P14	
R4	20 Ω		20 Ω
R10		33 Ω	

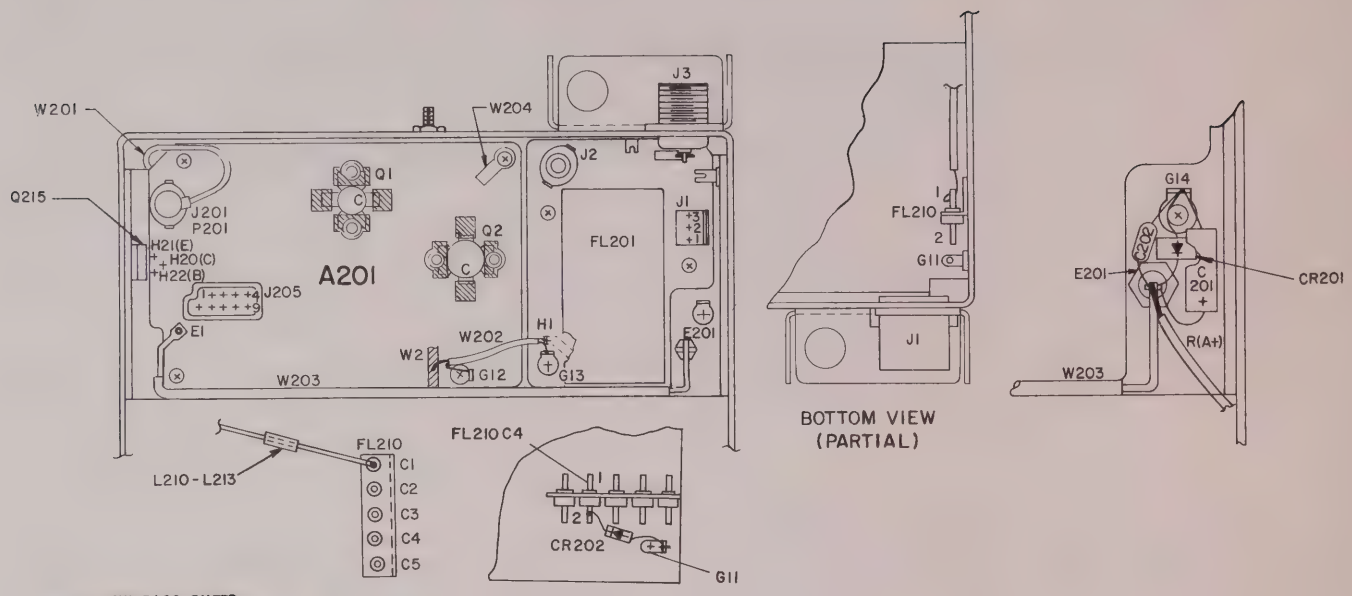


IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

SCHEMATIC DIAGRAM

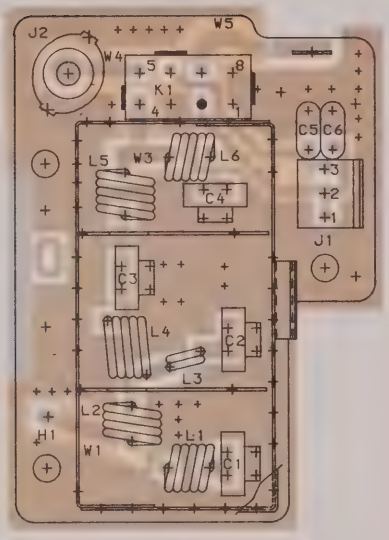
66—88 MHz POWER AMPLIFIER

POWER AMPLIFIER ASSEMBLY



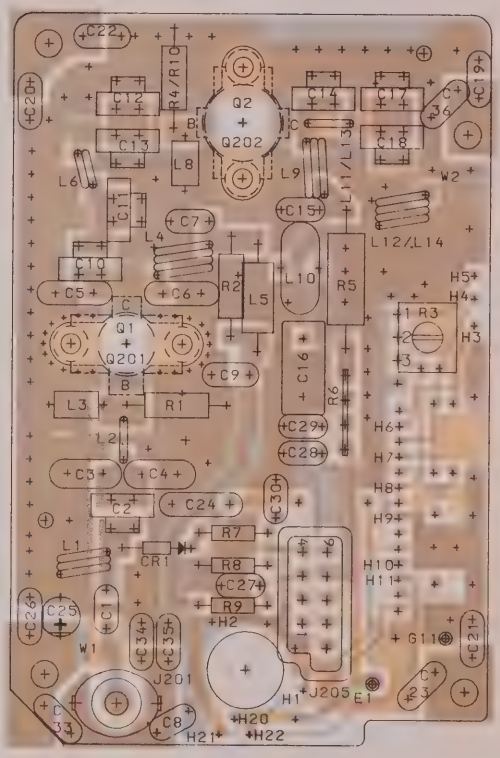
(19C328244, Rev. 0)

LOW PASS FILTER



(19C327954, Rev. 1)
(19B227596, Sh. 1, Rev. 0)
(19B227596, Sh. 2, Rev. 0)

PA BOARD



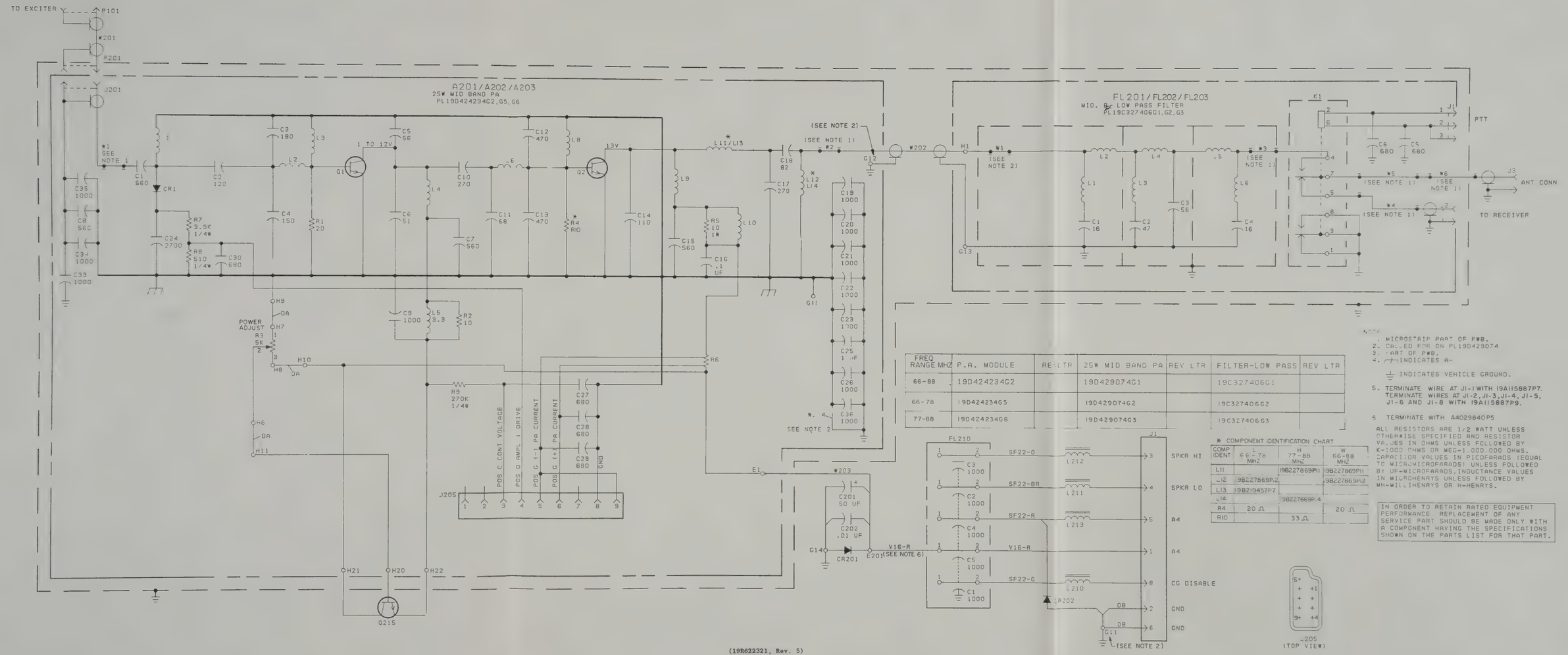
CONNECTION CHART			
FROM	TO	WIRE	REMARKS
H10	H8	DA	SLEEVE
H11	H6	DA	SLEEVE
H7	H9	DA	SLEEVE

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

(19C327844, Rev. 2)
(19B227591, Sh. 1, Rev. 1)
(19B227591, Sh. 2, Rev. 1)

OUTLINE DIAGRAM

66—88 MHz POWER AMPLIFIER



FREQ RANGE MHZ	P.A. MODULE	REV LTR	25W MID BAND PA	REV LTR	FILTER-LOW PASS	REV LTR
66-88	19D424234G2		19D429074G1		19C327406G1	
66-78	19D424234G5		19D429074G2		19C327406G2	
77-88	19D424234G6		19D429074G3		19C327406G3	

* COMPONENT IDENTIFICATION CHART

COMP IDENT	L 66-78 MHz	L 77-88 MHz	W 66-88 MHz
L11		19B227869P11	19B227869P11
L12	19B227869P2		19B227869P12
L13	19B219457P7		
L14		19B227869P4	
R4	20 Ω		20 Ω
R10		33 Ω	

NOTES:
1. MICROSTRIP PART OF PWB.
2. CABLED FOR ON PL19D429074
3. PART OF PWB.
4. ⏚ INDICATES A-
   ⏚ INDICATES VEHICLE GROUND.
5. TERMINATE WIRE AT J1-1 WITH 19A115887P7. TERMINATE WIRES AT J1-2, J1-3, J1-4, J1-5, J1-6 AND J1-8 WITH 19A115887P9.
6. TERMINATE WITH A4029840P5

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

J205 (TOP VIEW)

(19R622321, Rev. 5)

SCHEMATIC DIAGRAM

66—88 MHz POWER AMPLIFIER

Issue 2

PARTS LIST

LBI30638A

66-88 MHz, 25 WATT POWER AMPLIFIER
19D429074G1 66-88 MHz
19D429074G2 66-78 MHz
19D429074G3 77-88 MHz

SYMBOL	GE PART NO.	DESCRIPTION
A201		25 WATT MODULE 19D424234G2 66-88 MHz 19D424234G5 66-78 MHz 19D424234G6 77-88 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116655P15	Ceramic disc: 560 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A116679P120J	Silver mica: 120 pf ±5%, 250 VDCW.
C3	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C4	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C5	19A116656P56J8	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -80 PPM.
C6	19A116656P51J8	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -80 PPM.
C7 and C8	19A116655P15	Ceramic disc: 560 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C10	19A116679P270J	Silver mica: 270 pf ±5%, 250 VDCW.
C11	19A116679P68J	Silver mica: 68 pf ±5%, 250 VDCW.
C12 and C13	19A116679P470J	Silver mica: 470 pf ±5%, 250 VDCW.
C14	19A116679P110J	Silver mica: 110 pf ±5%, 250 VDCW.
C15	19A116655P15	Ceramic disc: 560 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C16	19A116966P107	Metallized polyester: 0.1 µf ±10%, 50 VDCW.
C17	19A116679P270J	Silver mica: 270 pf ±5%, 250 VDCW.
C18	19A116679P82J	Silver mica: 82 pf ±5%, 250 VDCW.
C19 thru C23	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C24	19A116655P21	Ceramic disc: 2700 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C25	19A134202P14	Tantalum: 1 µf ±20%, 35 VDCW.
C26	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C27 thru C30	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C33 thru C36	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19A134263P1	Contact, electrical: sim to Selectro 22901082-00-0-590.
G11	19A134263P1	Contact, electrical: sim to Selectro 229-1082-00-0-590.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J201	19A130924G1	Receptacle, coaxial: jack type; sim to Cinch 14H11613.
J205	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B227869P6	Coil.
L2	19B227869P7	Coil.
L3	19A129773G1	Coil.
L4	19B227869P8	Coil.
L5	7488079P10	Choke, RF: 3.30 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4421-1K.
L6	19B227869P9	Coil.
L8	19A129773G1	Coil.
L9	19B227869P10	Coil.
L10	19A129346G1	Coil.
L11	19B227869P11	Coil.
L12	19B227869P12	Coil.
L13	19B219457P7	Coil.
L14	19B227869P14	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A134489P1	Silicon, NPN.
Q2	19A134489P2	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P200J	Composition: 2 ohms ±5%, 1/2 w.
R2	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R3	19A116559P102	Variable, cermet: 5K ohms ±20%, .5 w; sim to CTS Series 360.
R4	3R77P200J	Composition: 20 ohms ±5%, 1/2 w.
R5	3R78P100J	Composition: 10 ohms ±5%, 1 w.
R6	19C320212P2	Shunt resistor.
R7	3R152P392J	Composition: 3.9K ohms ±5%, 1/4 w.
R8	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R9	3R152P274J	Composition: 270K ohms ±5%, 1/4 w.
R10	3R77P330J	Composition: 33 ohms ±5%, 1/2 w.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 and W2		(Part of 19D424233P1 printed board).
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Silicon, NPN; sim to Type 2N5210.
CR202	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal, stud.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL201 thru FL203		COMPONENT BOARD 19C327406G1 66-88 MHz 19C327406G2 66-78 MHz 19C327406G3 77-88 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A11679P16D	Metallized teflon: 17 pf ±.5 pf 250 VDCW.
C2	19A116679P47G	Metallized teflon: 47 pf ±2%, 250 VDCW.
C3	19A11679P56G	Silver mica: 56 pf ±2%, 250 VDCW.
C4	19A11679P16D	Metallized teflon: 117 pf ±.5 pf, 250 VDCW.
C5 and C6	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, receptacle: coaxial, jack type; sim to Cinch 14H116113.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180 to 341 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1	19B227869P1	Coil.
L2	19B227869P2	Coil.
L3	19B227869P3	Coil.
L4	19B227869P4	Coil.
L5	19B227869P5	Coil.
L6	19B227869P13	Coil.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		(Part of printed board 19C327405P1).
W3 thru W5		(Part of printed board 19C327405P1).
W6	19A136512P1	Antenna strap.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER ASSEMBLY 19A136680G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
G11 thru G14	7135118P2	Terminal, solderless: bend 90°.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contact, male: wire size No. 20-14 AWG; sim to AMP 60528-4.
	19A115884P9	Contact, male: wire size No. 30-22 AWG; sim to AMP 60910-4.
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-798.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P91	Cable, RF: approx 7-1/2 inches long; 350 VRMS, 500 VDC operating voltage. Includes P201.
W202	19A136529G2	Cable: approx 2 inches long.
W203	19B227302P1	Jumper.
W204	7878455P1	Solderless terminal.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - -
	19C321441P2	Insulator. (Located under A201).
	19A116023P3	Insulator, plate. (Used with Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	4033714P11	Solderless terminal. (Located at FL210).
	4029840P5	Contact, electrical. (Located at FL210- C5-1).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	N44P9006C6	Machine, screw: No. 4-40 x 3/8. (Secures Q1, Q2).
	19A116417P4	Plastic bumper. (Quantity 4).
	7878243P11	Hex nut. (Located on cover retaining stud).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

MAINTENANCE MANUAL

450—512 MHz POWER AMPLIFIER ASSEMBLY 19D423928G7

TABLE OF CONTENTS

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DESCRIPTION	1
CIRCUIT ANALYSIS	1
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PARTS LIST AND PRODUCTION CHANGES	4

DESCRIPTION

The PA Assembly for MASTR Custom MVP uses two RF power transistors to provide a power output of 5 Watts. The output power is adjustable over a range of 1.5 Watts to rated power output, using power adjust control R13. A single transistor is used in the power adjust circuit.

Supply voltage (A+) for the PA is connected from J1 on the back of the radio through FL210-C5 on the side of the radio. C201, C202, and C203 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J5 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power adjust voltage, and PA voltage and current.

CIRCUIT ANALYSIS

RF POWER AMPLIFIERS

The exciter output is coupled through RF cable W201 to PA input jack J1. The 50 ohm RF input is coupled through a matching network comprised of C6, C7, C8 and W2 to the base of amplifier Q1.

Part of the RF input is rectified by CR1 and metered at J5-4 through resistor R1.

Collector voltage for Q1 is applied directly from the DC power input through R4, collector stabilizing network R5 and L2 and collector feed network L3 and C10.

The output of Q1 is coupled to the base of PA Q202 through a matching network consisting of T1, C14, C15 and C16.

Collector voltage to Q202 is controlled by power adjust circuit, Q215, and is applied through a collector stabilizing network L10 and R6 and collector feed network L5 and C18.

Collector current for Q202 is metered through resistor R16. The reading is taken in position F with the High Sensitivity button pressed, and read as 0-1 ampere full scale.

Collector voltage for Q202 is metered through R2 to ground. The reading is taken in position C, Test 1 and read as 0-15 Volts full scale.

The output of Power Amplifier Q202 is coupled through an impedance matching network (W3, C17, C19 and C52) that matches the output impedance of Q202 to the input impedance of the low pass filter through a 50 ohm cable W202. C1 on the low pass filter board provides DC isolation between the transmitter and the antenna.

The PA output is coupled through the low-pass filter to the antenna through antenna relay K1.

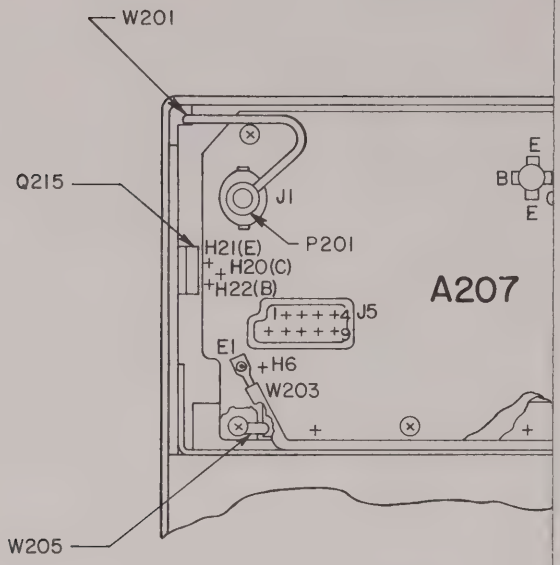
WARNING

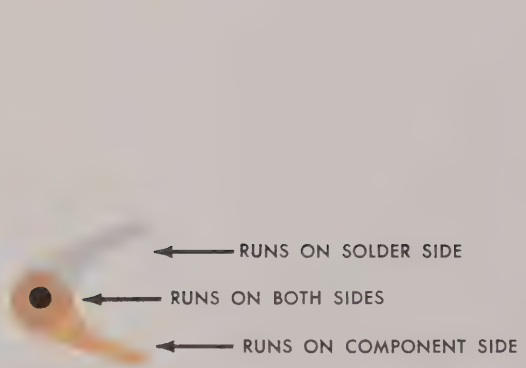
The RF Power Transistor used in the transmitter contains Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

POWER ADJUST CIRCUIT

The power adjust circuit consists of R13 and Q215. R13 controls the base voltage, and conduction of Q215. Q215 is connected in series with the collector feed network for Q202 thereby controlling the output power. R13 is adjusted to provide the desired output power.

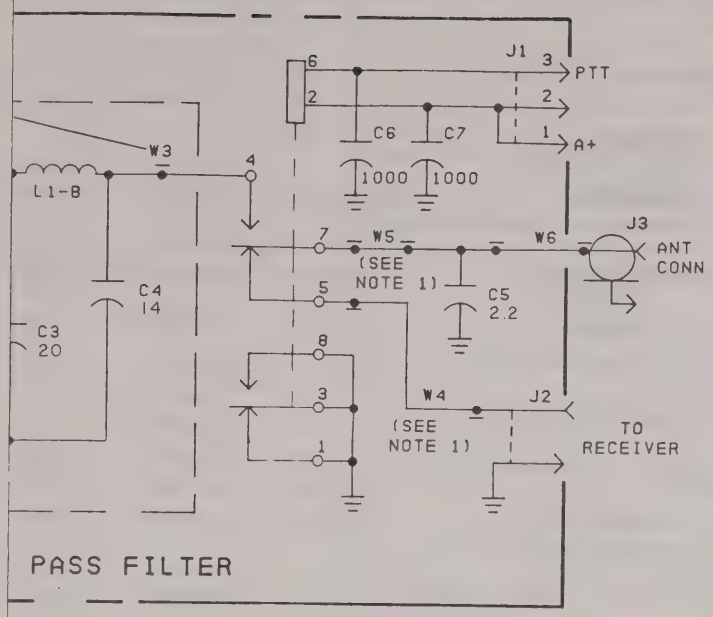
POWER AMPLI





OUTLINE DIAGRAM

450—512 MHz POWER AMPLIFIER



MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
327014G7		PL19C321963G2		PL19D423928G7		450-512 MHZ

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⫽⫽⫽ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

VOLTAGE READINGS

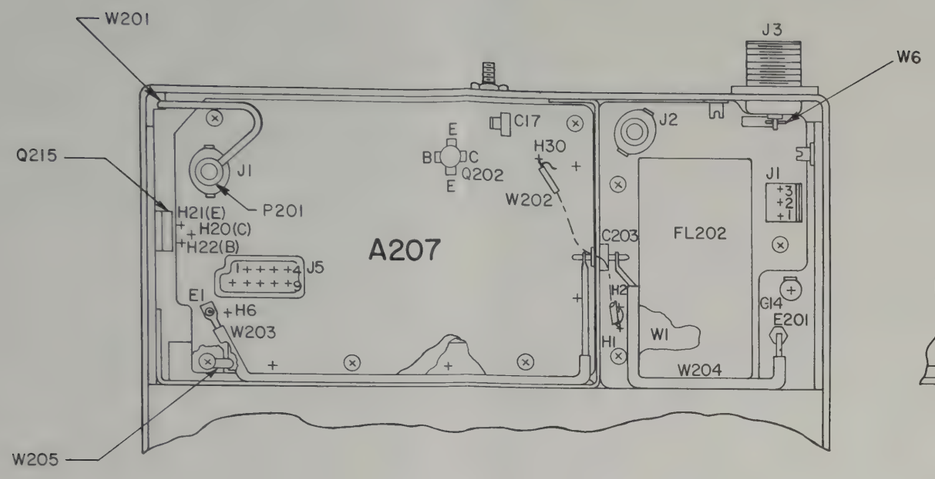
GE READINGS ARE TYPICAL READINGS MADE THE TRANSMITTER KEYED, AND MEASURED A 20,000 OHMS-PER-VOLT METER WITH ENCE TO A- AND NOT CHASSIS GROUND. AN OKE (25-50 MICROHENRYS) IS USED IN THE ETER LEAD TO AVOID DETUNING RF CIRCUITS. READINGS ARE TAKEN WITH TRANSMITTER TED TO RATED POWER OUTPUT.

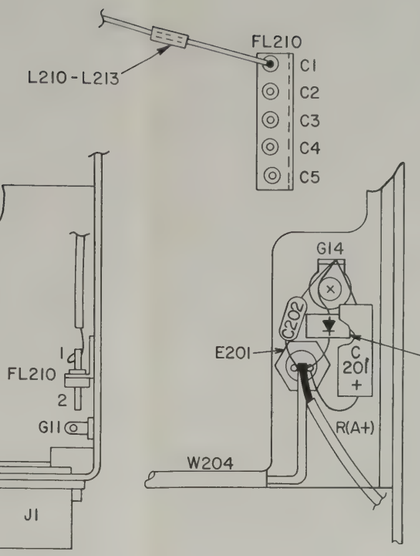
SCHEMATIC DIAGRAM

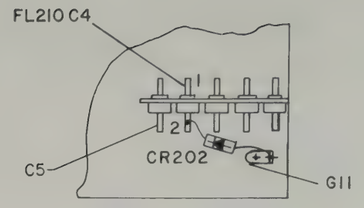
450—512 MHz POWER AMPLIFIER

Issue 1

POWER AMPLIFIER ASSEMBLY

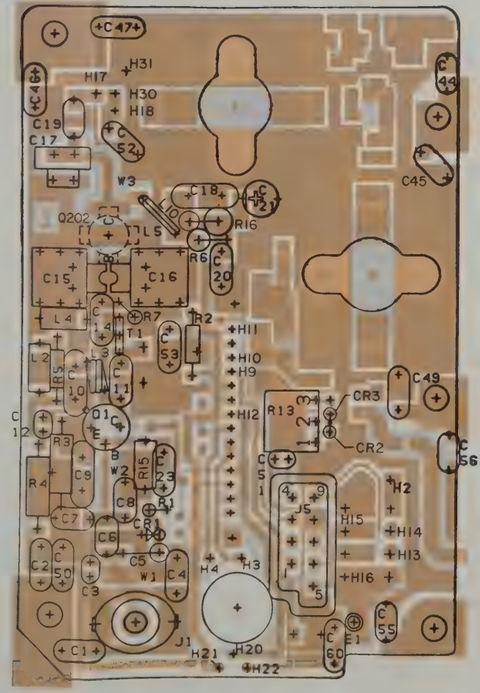




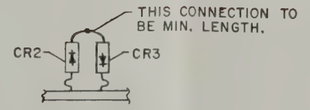


(19C327704, Rev. 0)

PA BOARD

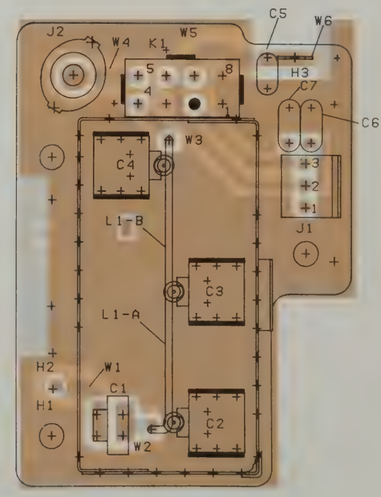


(19C327702, Rev. 0)
(19B226633, Sh. 1, Rev. 1)
(19B226633, Sh. 2, Rev. 1)



FROM	TO	WIRE	REMARKS
H9	HI0	DA	—
HII	HI2	DA	SLV
HI3	R6	SF22-R	
HI4	RI6	SF22-BL	
HI5	HI6	DA	SLV
HI7	HI8	DA	MIN. LG.

FILTER BOARD

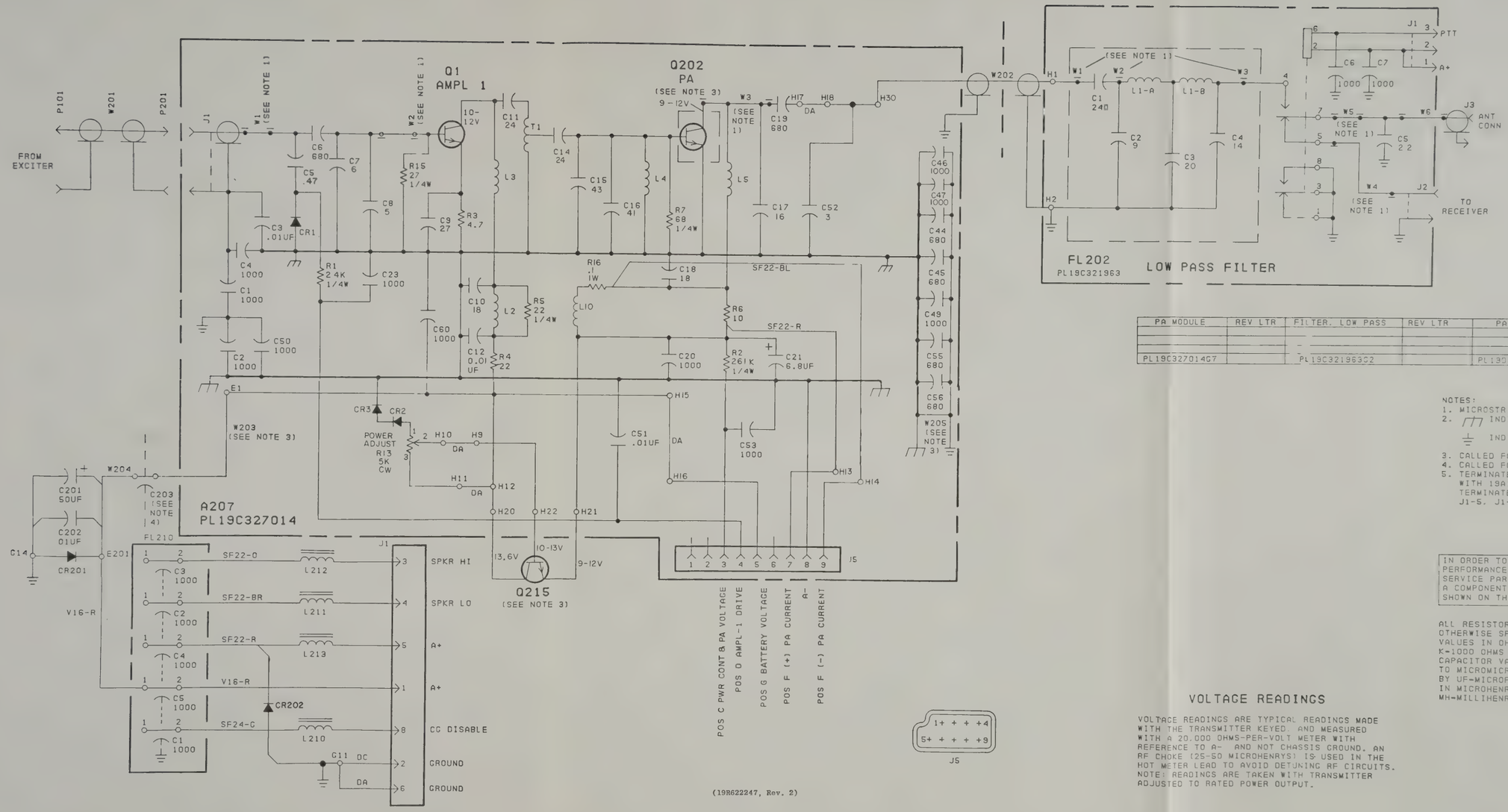


(19C327137, Rev. 1)
(19B227225, Sh. 1, Rev. 0)
(19B227225, Sh. 2, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

450—512 MHz POWER AMPLIFIER



PA MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
PL19C327014G7		PL19C321963G2		PL19D423928G7		450-512 MHZ

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⏚ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

SCHEMATIC DIAGRAM

450—512 MHz POWER AMPLIFIER

Issue 1

PARTS LIST

LBI-30396

450-512 MHz POWER AMPLIFIER
19D423928G7

SYMBOL	GE PART NO.	DESCRIPTION
A207		POWER AMPLIFIER MODULE 19C327014G7
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C3	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C4	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C5	5491601P113	Phenolic: 0.47 pf ±10%, 500 VDCW.
C6	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C7MA	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C8MA	19A116656P5J0	Ceramic disc: 5 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C9MA	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C10MA	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11MA	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C12	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C14MA	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C15MA	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C16MA	19A116952P41	Metallized teflon: 41 pf ±2%, 250 VDCW.
C17MA	19A116679P16D	Metallized teflon: 16 pf ±.5 pf, 250 VDCW.
C18	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C19	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C21	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C23	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C44 and C45	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C46 and C47	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C49 and C50	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C51	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C52MA	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C53	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C55 and C56	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C60	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - DIODES AND RECEPTACLES - - - - -
CR1	19A116052P1	Diode, silicon.
CR2 and CR3	19A115250P1	Silicon.
		- - - - - - - - - TERMINALS - - - - - - - - -
E1	19A134263P1	Contact, electrical; sim to Selectro X-L-070174-1.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
J5	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2	19A129773G1	Coil.
L3	19A129774P1	Coil.
L4	19A129773G1	Coil.
L5	19B219457P6	Coil.
L10	19A126140P3	Core, toroidal: sim to Stackpole 88-31959.
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q1	19A134237P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1MA	3R152P242J	Composition: 2400 ohms ±5%, 1/4 w.
R2	19C314256P22613	Metal film: 261,000 ohms ±1%, 1/4 w.
R3	7147161P13	Composition: 4.7 ohms ±5%, 1/2 w.
R4	3R77P220J	Composition: 22 ohms ±5%, 1/4 w.
R5	3R152P220J	Composition: 22 ohms ±5%, 1/4 w.
R6	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R7	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R13	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R15	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
R16	19B209022P89	Wirewound: 0.1 ohms ±5%, 2 w; sim to IRC Type BWH.
		- - - - - - - - - - TRANSFORMERS - - - - - - - -
T1	19A130446P1	Coil.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 thru W3		(Part of printed board 19D423005P1).
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C203	19B209488P2	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Style FA5D.
		- - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal, standoff.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL202		FILTER BOARD 19C321963G2
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116679P240J	Silver mica: 240 pf ±5%, 250 VDCW.

SYMBOL	GE PART NO.	DESCRIPTION
C2H	19A116952P9	Metallized teflon: 9 pf ±0.5 pf, 250 VDCW.
C3H	19A116952P20	Metallized teflon: 20 pf ±0.5 pf, 250 VDCW.
C4H	19A116952P12	Metallized teflon: 12 pf ±0.5 pf, 250 VDCW.
C5H	19A134100P20	Ceramic: 2.2 pf ±0.1 pf, 100 VDCW.
C6 and C7	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180 to 341 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1H	19B227240P2	Jumper.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 thru W5		(Part of printed board 19C321962P1).
W6	19A136512P1	Antenna strap.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER 19A136680G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
G11 and G12	7135118P2	Terminal, solderless.
G14	7135118P2	Terminal, solderless.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1.
	19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1.
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-798.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P201		(Part of W201).
		- - - - - - - - - - TRANSISTORS - - - - - - - -
Q202	19A134164P2	Silicon, NPN; sim to Type 2N5945.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P91	Cable, RF: approx 7-1/2 inches long.
W202	19A136529G1	Cable: approx 4 inches long.
W203	19C327146P1	Jumper.
W204	19C327146P2	Jumper.
W205	7135118P1	Terminal, solder.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C321982P1	Insulator. (Located under A207).
	19B227353G1	Shield. (Located around A207).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures shield to frame at C17).
	19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16. (Secures shield to frame at J5).
	5492178P2	Washer, spring tension. (Used with Q202).
	N207P15C6	Hex nut: No. 8-32. (Used with Q202).
	19A130465P1	Spacer. (Used with Q202).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL202).
	19B209209P304	Tap screw, Phillips Pozidrive: No. 6-32 x 1/4. (Secures FL210).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	4036555P1	Insulator, washer: nylon. (Used with Q1).
	19B219554G2	Can. (FL202).
	19B219555P1	Cover. (FL202).
	19B209502P1	Terminal, stud. (Used with C2, C3, C4, L1).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

GE PART NO.	DESCRIPTION
	- - - - - - - - - MISCELLANEOUS - - - - - - - - -
19C321982P1	Insulator. (Located under A207).
19B227353G1	Shield. (Located around A207).
19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures shield to frame at C17).
19B201074P305	Tap screw, Phillips POZIDRIV®: No. 6-32 x 5/16. (Secures shield to frame at J5).
5492178P2	Washer, spring tension. (Used with Q202).
N207P15C6	Hex nut: No. 8-32. (Used with Q202).
19A130465P1	Spacer. (Used with Q202).
19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
19A134016P1	Insulator, bushing. (Used with Q215).
7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL202).
19B209209P304	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/4. (Secures FL210).
19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
4036555P1	Insulator, washer: nylon. (Used with Q1).
19B219554G2	Can. (FL202).
19B219555P1	Cover. (FL202).
19B209502P1	Terminal, stud. (Used with C2, C3, C4, L1).

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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ECP-824

MOBILE RADIO

25W

MAINTENANCE MANUAL
30—50 MHz POWER AMPLIFIER BOARD 19D423926G2-4

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DESCRIPTION

The 30-50 MHz PA assembly for MASTR Custom MVP uses two RF power transistors to provide a power output of 25 Watts. The output power is adjustable using power adjust control R19 over a range of 8 to 25 watts. A single transistor is used in the power adjust circuit.

Supply voltage (A+) for the PA is connected from J1 on the back of the radio through FL210-C5 on the side of the radio. C201, C202 and L15 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J5 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power adjust voltage, PA current and voltage.

CIRCUIT ANALYSIS

RF AMPLIFIERS

The exciter output is coupled through cable W201 to PA input jack J1. The RF is coupled through DC blocking capacitor C1 and an impedance matching network to the base of Class C amplifier Q201. The network matches the 50-ohm input to the base of Q201, and consists of C3, C4, C5, L1 and L2. R3, R4, R5 and R6 lower the gain of the amplifier stage. L3 provides the DC return to the base of Q201.

Part of the RF input is rectified by CR1 and applied to voltage divider R1 and R2. This voltage is used to meter the AMPL-1 drive at J5-4.

Collector voltage to Q201 (Ampl-1) is controlled by the power adjust circuit, Q215 and is applied through collector stabilizing network (L5 and R7) and collector feed network L4 and C8. The collector voltage of Q201 is metered through R18 and J5-3.

Following Q201 is a matching network (C6, C7, C11, C212, C213, L6 and L27) to a resistive pad (R8, R9 and R10). The output of the resistor network is applied to the base of Power Amplifier Q202 through a matching network consisting of C14, C15, C16, L8 and L9. Resistors R11 through R16 lower the gain of Q202 and adjust the impedance levels. L10 provides the DC return to the base of Q202.

Collector voltage to Q202 is coupled through a collector stabilizing network consisting of L12 and R17 and collector feed network L11 and C19.. PA voltage is metered from tapped manganin resistor R20 to ground. The reading is taken in position G on the 15 volt scale (4EX3A11) and read as 15 volts full scale. The meter polarity must be reversed.

Collector current for Q202 is metered through tapped manganin resistor R20 at J5-7 (PA CURRENT). The reading is taken on the one-Volt scale with the High Sensitivity button pressed, and read as 10 amperes full scale.

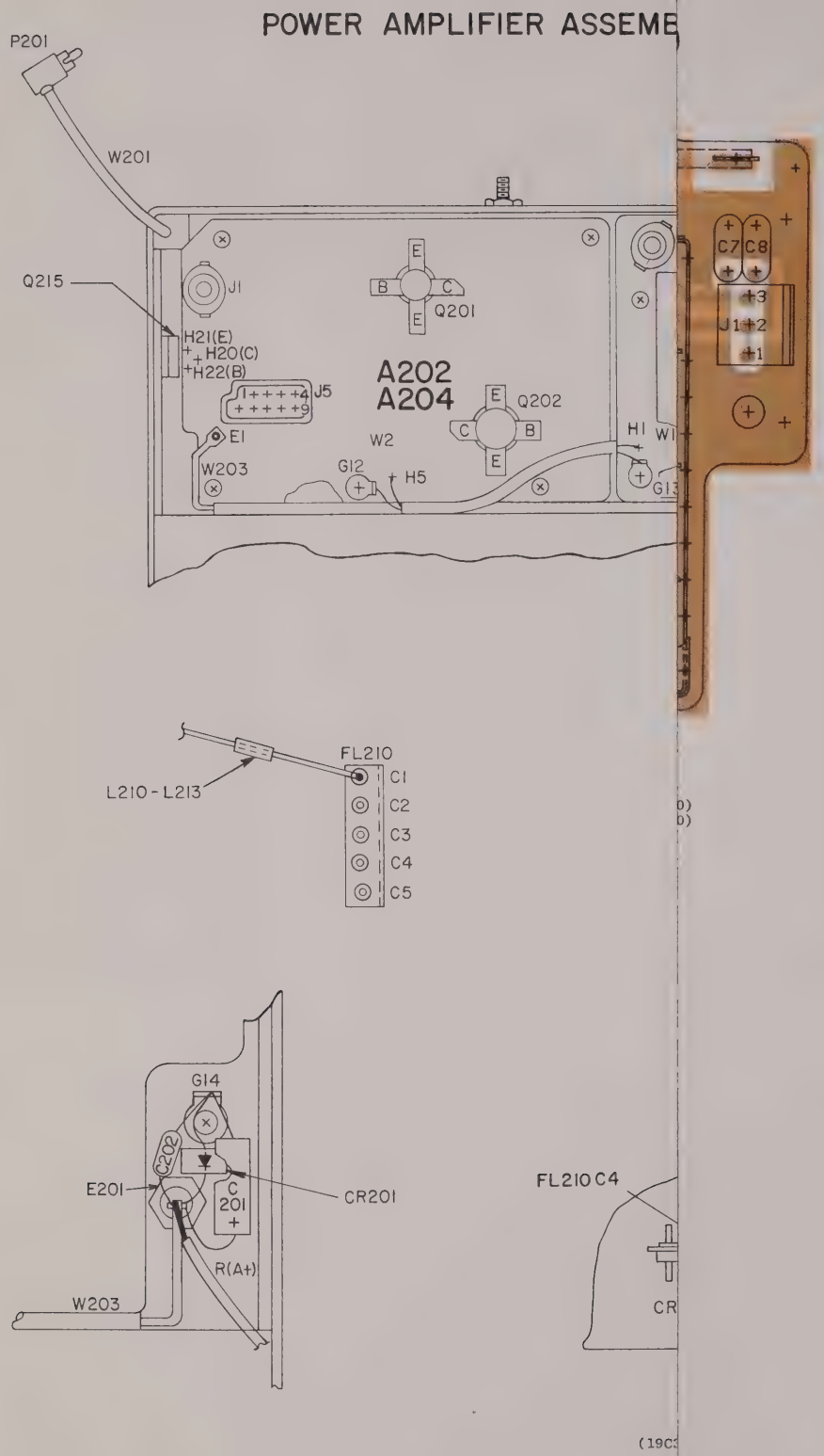
Following Q202 is a matching network (C17, C18, C21, C22, C23, L11, L13 and L14) that matches the PA output to the input of the low pass filter through a 50 ohm microstrip W2, cable W202 and a matching 50-ohm microstrip W1 on the input to the low pass filter. The output of the low pass filter is coupled through a third 50-ohm microstrip to antenna relay K1 and then to antenna connector J3. The receiver connection is made at J2.

WARNING

The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

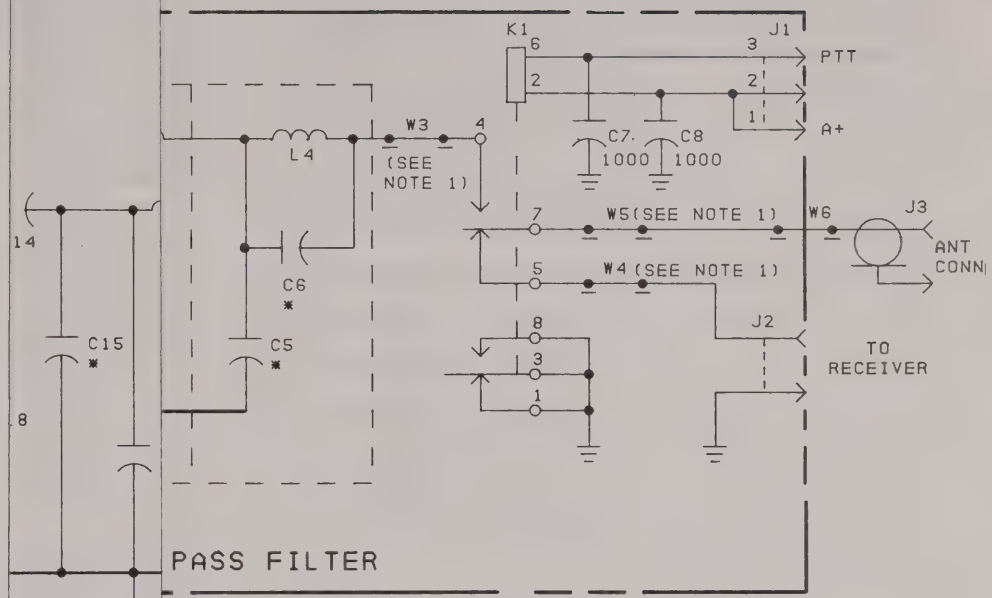
POWER ADJUST CIRCUIT

The power adjust circuit consists of R19 and Q215. R19 controls the base voltage and conduction of Q215. Q215 emitter is connected in series with the collector feed network for Q201 thereby controlling the drive to Power Amplifier Q202 and the output power. R19 is adjusted to provide the desired output power. The collector voltage for Q201 is measured on position C on the 15 volt scale and read as 0-15 volts full scale.



OUTLINE DIAGRAM

30—50 MHz POWER AMPLIFIER



LTR	PA ASSY	REV LTR	FREQ
	PL19D423926G2		30-36 MHZ(L)
	PL19D423926G3		36-42 MHZ(M)
	PL19D423926G4		42-50 MHZ(H)

FL202, FL203, FL204
PL19C321957

*COMPONENT VALUE AS FOLLOWS:				
COMPONENT DESIGNATION		30-36 MHZ L	36-42 MHZ M	42-50 MHZ H
C1		68	56	51
C2		91	68	56
C3		13	12	10
C4		110	91	82
C5		100	82	75
C6		68	56	51

5 6 7 8

POS G P.A. VOLTAGE
POS F (+) P.A. CURRENT
A-

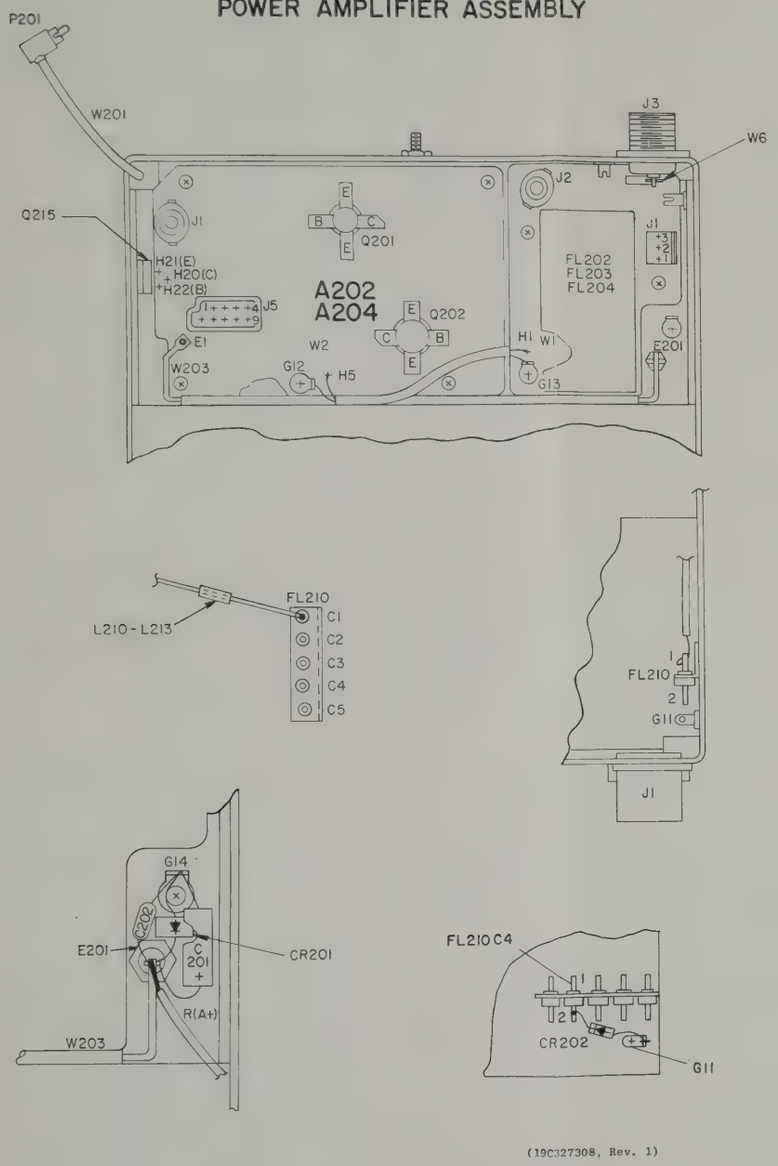
NOTES:
1. MICROSTRIP (PART OF PW BD).
2. INDICATES A-
   INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423926.
4. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9.

SCHEMATIC DIAGRAM

30—50 MHz POWER AMPLIFIER

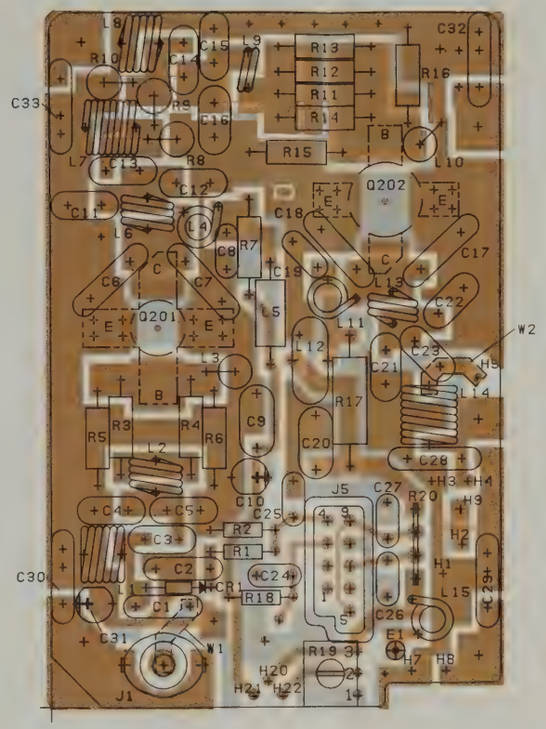
Issue 2

POWER AMPLIFIER ASSEMBLY



(19C327308, Rev. 1)

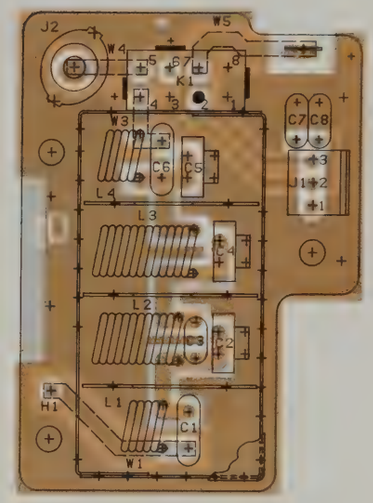
PA BOARD



CONNECTION CHART		
FROM	TO	WIRE SIZE
H3	H4	DB
H7	H8	DB

(19C327141, Rev. 0)
(19B227209, Sh. 2, Rev. 0)
(19B227209, Sh. 3, Rev. 0)

FILTER BOARD

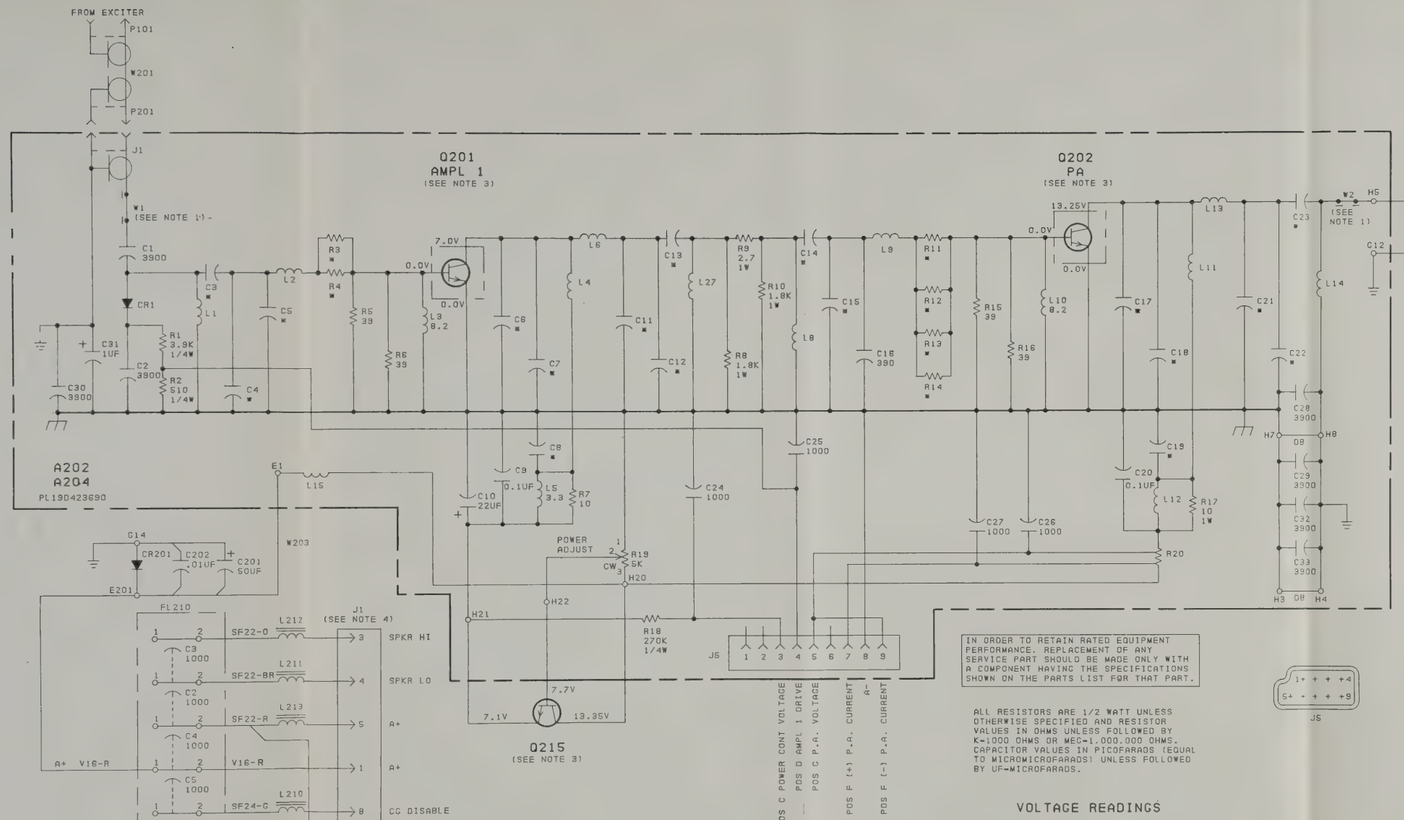


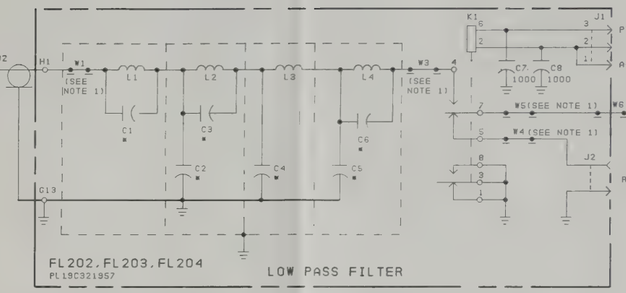
(19C327143, Rev. 0)
(19B227218, Sh. 2, Rev. 0)
(19B227218, Sh. 3, Rev. 0)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

OUTLINE DIAGRAM

30—50 MHz POWER AMPLIFIER





PA MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
PL19D423690C2		PL19C321957C2		PL19D423926C2		30-36 MHZ(L)
PL19D423690C4		PL19C321957C3		PL19D423926C3		36-42 MHZ(M)
PL19D423690C4		PL19C321957C4		PL19D423926C4		42-50 MHZ(H)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED, AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

(19R622211, Rev. 3)

A202, A204 PL19D423690

*COMPONENT VALUE AS FOLLOWS

COMPONENT DESIGNATION	30-36 MHZ L	M	36-50 MHZ H
C3	220		180
C4	150		120
C5	120		100
C6	300		180
C7	300		180
C8	1000		680
C11	180		150
C12	180		100
C13	150		150
C14	220		220
C15	470		470
C17	130		91
C18	130		91
C19	1000		680
C21	270		270
C22	270		120
C23	150		120
R3	10		4.7
R4	10		4.7
R11	3.9		1.2
R12	3.9		1.2
R13	3.9		1.2
R14	3.9		1.2

FL202, FL203, FL204 PL19C321957

*COMPONENT VALUE AS FOLLOWS

COMPONENT DESIGNATION	30-36 MHZ L	36-42 MHZ M	42-50 MHZ H
C1	68	56	51
C2	91	68	56
C3	13	12	10
C4	110	91	82
C5	100	82	75
C6	68	56	51

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⏚ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423926.
4. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4 J1-5, J1-6 & J1-8 WITH 19A115884P9.

SCHEMATIC DIAGRAM

30—50 MHz POWER AMPLIFIER

PARTS LIST

LBI-30170A

30-50 MHz POWER AMPLIFIER
19D423926G2 30-36 MHz (L)
19D423926G3 36-42 MHz (M)
19D423926G4 42-50 MHz (H)

SYMBOL	GE PART NO.	DESCRIPTION
A202 and A204		POWER AMPLIFIER MODULE 19D423690G2 30-36 MHz 19D423690G4 36-50 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C3L	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C3H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C4L	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C4H	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C5L	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C5H	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C6L	19A116656P300J15	Ceramic disc: 300 pf ±5%, 500 VDCW, temp coef -1500 PPM.
C6H	19A116656P180J4	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -470 PPM.
C7L	19A116656P300J15	Ceramic disc: 300 pf ±5%, 500 VDCW, temp coef -1300 PPM.
C7H	19A116656P180J4	Ceramic disc: 180 pf ±5%, 500 VDCW, temp coef -470 PPM.
C8L	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C8H	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C9	19A116966P107	Metallized polyester: .1 µf ±10%, 50 VDCW.
C10	19A134202P6	Tantalum: 22 µf ±20%, 15 VDCW.
C11L	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11H	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C12L	7489162P33	Silver mica: 180 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C12H	7489162P27	Silver mica: 100 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C13L	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C13H	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C14L	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C14H	7489162P35	Silver mica: 220 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C15L	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C15H	7489162P43	Silver mica: 470 pf ±5%, 300 VDCW; sim to Electro Motive Type DM-15.
C16	7489162P41	Silver mica: 390 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C17L	19A116656P130J1	Ceramic disc: 130 pf ±5%, 500 VDCW, temp coef -150 PPM.
C17H	19A116656P91J0	Ceramic disc: 91 pf ±5%, 500 VDCW, temp coef 0 PPM.

SYMBOL	GE PART NO.	DESCRIPTION
C18L	19A116656P130J1	Ceramic disc: 130 pf ±5%, 500 VDCW, temp coef -150 PPM.
C18H	19A116656P91J0	Ceramic disc: 91 pf ±5%, 500 VDCW, temp coef 0 PPM.
C19L	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C19H	19A116655P17	Ceramic disc: 680 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C20	19A116966P107	Metallized polyester: .1 µf ±10%, 50 VDCW.
C21L	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C21H	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C22L	7489162P37	Silver mica: 270 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C22H	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C23L	7489162P31	Silver mica: 150 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C23H	7489162P29	Silver mica: 120 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C24 thru C27	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C28 thru C30	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C31	19A134202P14	Tantalum: 1 µf ±20%, 35 VDCW.
C32 and C33	19A116655P23	Ceramic disc: 3900 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1	19A115250P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19A134263P1	Contact, electrical: sim to Selectro X-L-070174-1.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1	19A130924G1	Receptacle, coaxial: jack type; sim to Cinch 14H11613.
J5	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1L	19C320617P23	Coil.
L1H	19C320617P24	Coil.
L2L	19C320617P5	Coil.
L2H	19C320617P25	Coil.
L3	7488079P42	Choke, RF: 8.20 µh ±10%, 0.25 ohms DC res max; sim to Jeffers 4422-3.
L4L	19C320618P6	Coil.
L4H	19C320618P1	Coil.
L5	7488079P10	Choke, RF: 3.30 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4421-1.
L6L	19C320617P26	Coil.
L6H	19C320617P6	Coil.
L7L	19C320617P28	Coil.
L7H	19C320617P29	Coil.
L8L	19C320617P30	Coil.
L8H	19C320617P43	Coil.
L9L	19C320618P7	Coil.
L9H	19C320619P6	Coil.
L10	7488079P42	Choke, RF: 8.20 µh ±10%, 0.25 ohms DC res max; sim to Jeffers 4422-3.
L11L	19C320618P6	Coil.
L11H	19C320618P8	Coil.

SYMBOL	GE PART NO.	DESCRIPTION
L12	19A129346G1	Coil.
L13L	19C320617P4	Coil.
L13H	19C320617P12	Coil.
L14L	19C320617P38	Coil.
L14H	19C320617P39	Coil.
L15	19C320318P1	Coil.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P392J	Composition: 3900 ohms ±5%, 1/4 w.
R2	3R152P511J	Composition: 510 ohms ±5%, 1/4 w.
R3L	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R3H	7147161P13	Composition: 4.7 ohms ±5%, 1/2 w.
R4L	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R4H	7147161P13	Composition: 4.7 ohms ±5%, 1/2 w.
R5 and R6	3R77P390J	Composition: 39 ohms ±5%, 1/2 w.
R7	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R8	3R78P182J	Composition: 1800 ohms ±5%, 1 w.
R9	5490205P16	Composition: 2.7 ohms ±5%, 1 w.
R10	3R78P182J	Composition: 1800 ohms ±5%, 1 w.
R11L	7147161P34	Composition: 3.9 ohms ±5%, 1/2 w.
R11H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R12L	7147161P34	Composition: 3.9 ohms ±5%, 1/2 w.
R12H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R13L	7147161P34	Composition: 3.9 ohms ±5%, 1/2 w.
R13H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R14L	7147161P34	Composition: 3.9 ohms ±5%, 1/2 w.
R14H	7147161P22	Composition: 1.2 ohms ±5%, 1/2 w.
R15 and R16	3R77P390J	Composition: 39 ohms ±5%, 1/2 w.
R17	3R78P100K	Composition: 10 ohms ±10%, 1 w.
R18	3R152P274J	Composition: 0.27 megohm ±5%, 1/4 w.
R19	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R20	19C320212P2	Shunt resistor.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 and W2		(Part of printed board 19D423689P1).
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal standoff.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL202 thru FL204		FILTER BOARD FL202 19C321957G2 30-36 MHz (L) FL203 19C321957G3 36-42 MHz (M) FL204 19C321957G4 42-50 MHz (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1L	19A116656P6&J1	Ceramic disc: 68 pf ±5%, 500 VDCW, temp coef -150 PPM.
C1M	19A116656P56J1	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.

SYMBOL	GE PART NO.	DESCRIPTION
C1H	19A116656P51J1	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C2L	19A116679P91J	Mica: 91 pf ±5%, 250 VDCW.
C2M	19A116679P68J	Mica: 68 pf ±5%, 250 VDCW.
C2H	19A116679P56J	Mica: 56 pf ±5%, 250 VDCW.
C3L	19A116656P13J1	Ceramic disc: 13 pf ±5%, 500 VDCW, temp coef -150 PPM.
C3M	19A116656P12J1	Ceramic disc: 12 pf ±5%, 500 VDCW, temp coef -150 PPM.
C3H	19A116656P10J1	Ceramic disc: 10 pf ±0.5 pf, 500 VDCW, temp coef -150 PPM.
C4L	19A116679P110J	Mica: 110 pf ±5%, 250 VDCW.
C4M	19A116679P91J	Mica: 91 pf ±5%, 250 VDCW.
C4H	19A116679P82J	Mica: 82 pf ±5%, 250 VDCW.
C5L	19A116679P100J	Mica: 100 pf ±5%, 250 VDCW.
C5M	19A116679P82J	Mica: 82 pf ±5%, 250 VDCW.
C5H	19A116679P75J	Mica: 75 pf ±5%, 250 VDCW.
C6L	19A116656P68J1	Ceramic disc: 68 pf ±5%, 500 VDCW, temp coef -150 PPM.
C6M	19A116656P56J1	Ceramic disc: 56 pf ±5%, 500 VDCW, temp coef -150 PPM.
C6H	19A116656P51J1	Ceramic disc: 51 pf ±5%, 500 VDCW, temp coef -150 PPM.
C7 and C8	19A116655P19	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, receptacle: coaxial, jack type; sim to Cinch 14H11613.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180 to 330 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC nominal; sim to GE 33AV1760A2.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1L	19A129360P6	Coil.
L1M	19A129360P4	Coil.
L1H	19A129360P1	Coil.
L2L	19A129360P7	Coil.
L2M	19A129360P3	Coil.
L2H	19A129360P2	Coil.
L3L	19A129360P8	Coil.
L3M	19A129360P5	Coil.
L3H	19A129360P3	Coil.
L4L	19A129360P6	Coil.
L4M	19A129360P4	Coil.
L4H	19A129360P1	Coil.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1		(Part of printed board 19C321934P1).
W3 thru W5		(Part of printed board 19C321934P1).
W6	19A136512P1	Antenna strap.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER ASSEMBLY 19A136680G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - TERMINALS - - - - - - - - - -
G11 thru G14	7135118P2	Terminal, solderless.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1. (Quantity 2).
	19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1. (Quantity 5).
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-79S.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P201		(Part of W201).
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q201	19A116965P1	Silicon, NPN.
Q202	19A134104P1	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491688P91	Cable, RF: approx 7-1/2 inches long.
W202	19A136529G1	Cable: approx 4 inches long.
W203	19B227302P1	Jumper.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19A136518P1	Shield. (Used with FL202-FL204).
	19B219555P1	Cover. (Used with FL202-FL204).
	19C321982P1	Insulator. (Located under A202, A204).
	4033714P11	Solderless terminal: sim to Zierick 349. (Used with FL202-FL204).
	19B209209P304	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/4. (Secures FL210).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	5492178P2	Washer, spring tension: sim to Wallace Barnes 375-20. (Used with Q201, Q202).
	N207P15C6	Nut, hex: No. 8-32. (Secures Q201).
	N207P16C6	Nut, hex: No. 10-32. (Secures Q202)
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Used with Q215).
	19A134016P1	Insulator, bushing. (Used with Q215)
	7878243P11	Nut, hex: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	NP280071	Nameplate. (CAUTION).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-3166

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.

MAINTENANCE MANUAL
406—420 & 450—512 MHz POWER AMPLIFIER ASSEMBLY 19D423928G1, G3

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CIRCUIT ANALYSIS ..... Page 1
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DESCRIPTION

The PA Assembly for MASTR Custom MVP uses three RF power transistors to provide a power output of 20 Watts. The output power is adjustable over a range of 10 Watts to rated power output, using power adjust control R13. A single transistor is used in the power adjust circuit.

Supply voltage (A+) for the PA is connected from J1 on the back of the radio through FL210-C5 on the side of the radio. C201, C202, and C203 prevent RF from getting on the power leads. Diode CR201 will cause the main fuse assembly to blow if the polarity of the power leads is reversed, providing reverse voltage protection for the radio.

Centralized metering jack J5 is provided for use with GE Test Set Model 4EX3A11 or Test Kit 4EX8K12. The Test Set meters the Ampl-1 drive (exciter output), power adjust voltage, and PA voltage and current.

CIRCUIT ANALYSIS

RF POWER AMPLIFIERS

The exciter output is coupled through RF cable W201 to PA input jack J1. The 50 ohm RF input is coupled through a matching network comprised of C6, C7, C8 and W2 to the base of amplifier Q1.

Part of the RF input is rectified by CR1 and metered at J5-4 through resistor R1.

Collector voltage for Q1 is applied direct from the DC power input through R14, collector stabilizing network R5 and L2 and collector feed network L3 and C10.

The output of Q1 is coupled to the base of driver Q202 through a matching network consisting of T1, C13, C14, C15 and C16.

Collector voltage to Q202 is controlled by power adjust circuit, Q215, and is applied through a collector stabilizing network L6 and R6 and collector feed network L5 and C18.

The output of Q202 is coupled to the base of power amplifier Q203 through C19 and a matching network consisting of T2, C22, C24, C25, and C52. The collector voltage to Q203 is coupled through collector stabilizing network L9 and R14 and collector feed network L8 and C61.

Collector current for Q203 is metered from tapped manganin resistor R12. The reading is taken in position F with the High Sensitivity button pressed, and read as 0-15 amperes full scale.

Collector voltage for Q203 is metered from tapped manganin resistor R10 to ground. The reading is taken in position G on the 15-Volt scale (4EX3A11) and read as 0-15 Volts full scale. The meter polarity must be reversed.

The output of Power Amplifier Q203 is coupled through an impedance matching network (C29, C30 and T3) that matches the output impedance of Q203 to the input impedance of the low pass filter through a 50 ohm micro strip (W4) and a 50 ohm cable W202. C1 on the low pass filter board provides DC isolation between the transmitter and the antenna.

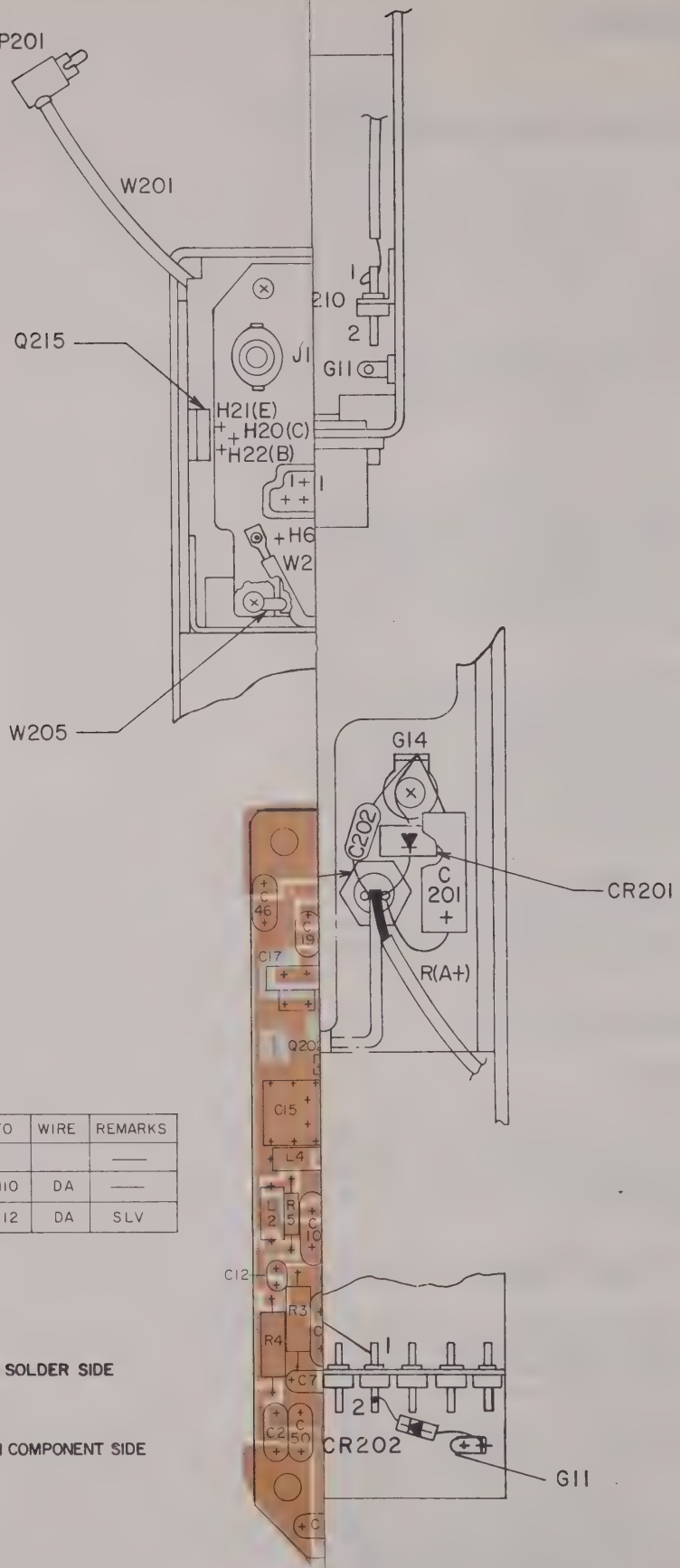
The PA output is coupled through the low-pass filter to the antenna through antenna relay K1.

WARNING

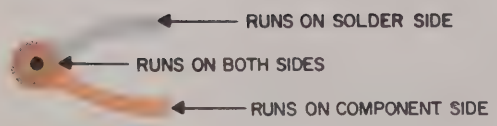
The RF Power Transistors used in the transmitter contain Beryllium Oxide, a TOXIC substance. If the ceramic, or other encapsulation is opened, crushed, broken or abraded, the dust may be hazardous if inhaled. Use care in replacing transistors of this type.

POWER ADJUST CIRCUIT

The power adjust circuit consists of R13 and Q215. R13 controls the base voltage, and conduction of Q215. Q215 is connected in series with the collector feed network for Q202 thereby controlling the drive to Power Amplifier Q203 and the output power. R13 is adjusted to provide the desired output power. The collector voltage for Q202 is measured on position C on the 15-Volt scale and read as 0-15 volts full scale.

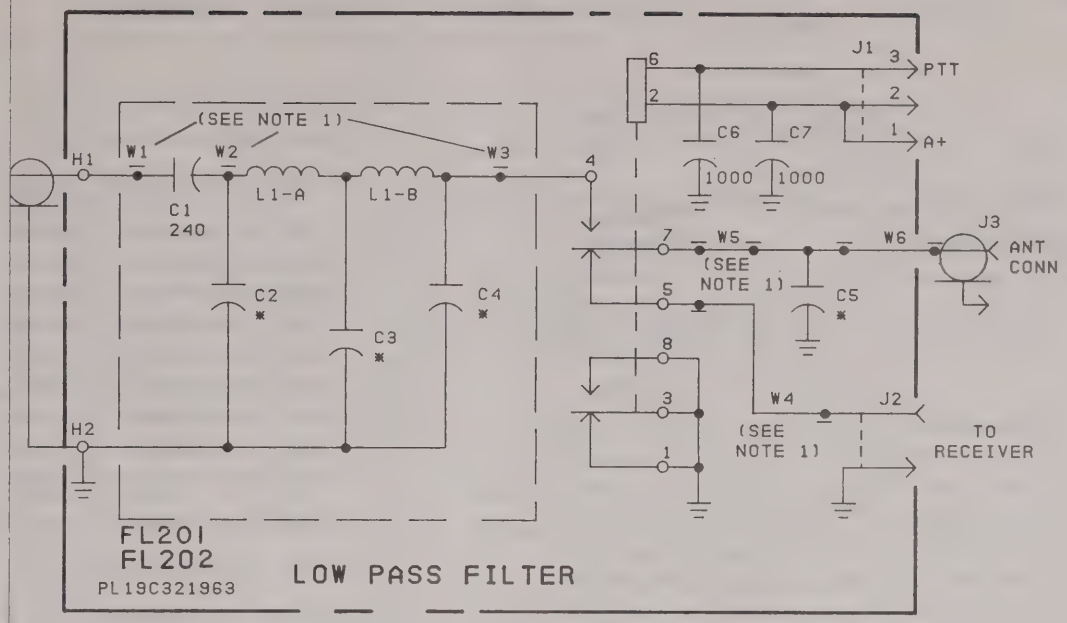


FROM	TO	WIRE	REMARKS
			——
H9	H10	DA	——
H11	H12	DA	SLV



OUTLINE DIAGRAM

406—420 & 450—512 MHz
POWER AMPLIFIER



MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
327014G1	B	PL19C321963G1		PL19D423928G1		406-450 MHZ
327014G3	B	PL19C321963G2		PL19D423928G3		450-512 MHZ

*COMPONENT VALUE AS FOLLOWS:

COMP IDENT	LL 406-450 MHZ	H 450-512 MHZ
C7	8	6
C8	8	6
C9	33	27
C10	27	18
C11	33	24
C13	4	OMIT
C14	33	24
C15	47	43
C16	51	43
C17	18	16
C22	33	24
C24	41	35
C25	43	33
C26	47	37
C27	43	35
C29	33	24
C30	8	4
C2	10	2
C3	22	19
C4	13	12
C5	OMIT	2.2

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⊓⊓ INDICATES A-

   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERMINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERMINATE WIRES AT J1-3, J1-4, J1-5, J1-6 & J1-8 WITH 19A115884P9.

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K-1000 OHMS OR MEG-1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF-MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH-MILLIHENRYS OR H-HENRYS.

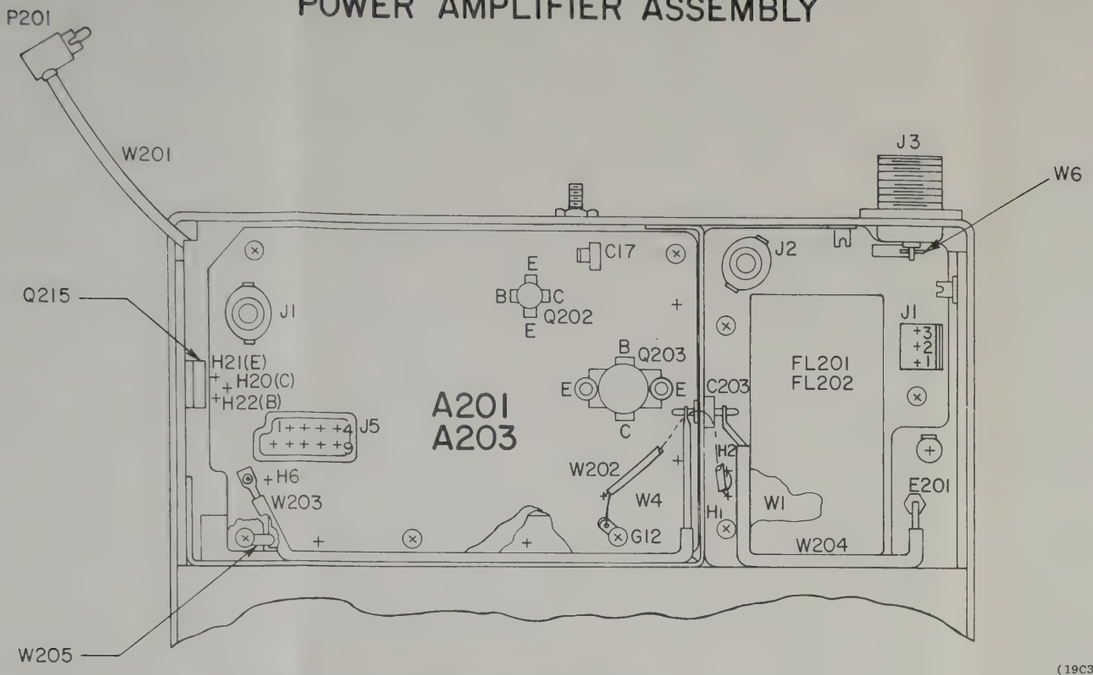
VOLTAGE READINGS

E READINGS ARE TYPICAL READINGS MADE HE TRANSMITTER KEYED, AND MEASURED 20,000 OHMS-PER-VOLT METER WITH NCE TO A- AND NOT CHASSIS GROUND. AN KE (25-50 MICROHENRYS) IS USED IN THE TER LEAD TO AVOID DETUNING RF CIRCUITS. READINGS ARE TAKEN WITH TRANSMITTER ED TO RATED POWER OUTPUT.

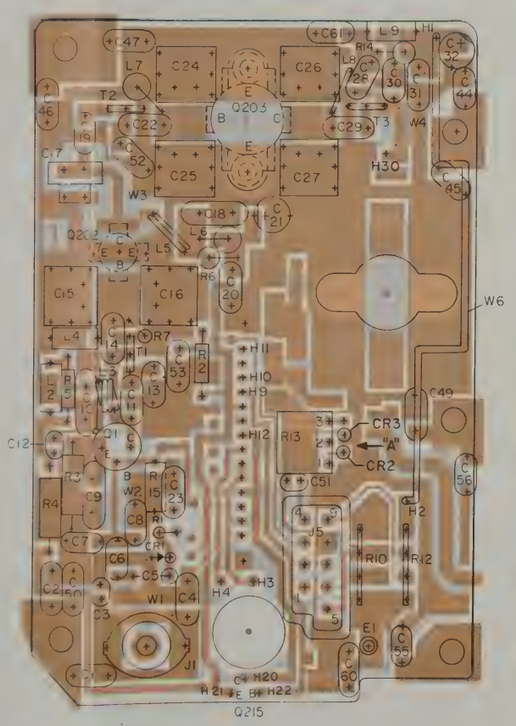
SCHEMATIC DIAGRAM

406—420 & 450—512 MHz
POWER AMPLIFIER

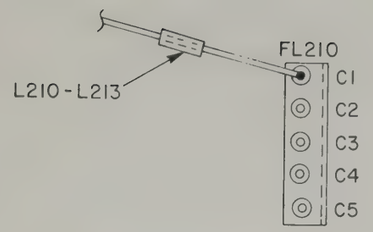
POWER AMPLIFIER ASSEMBLY

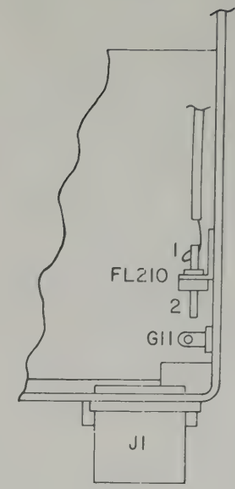


PA BOARD

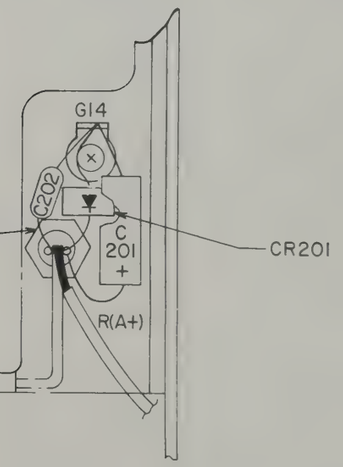


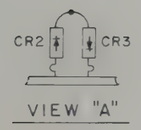
(19C327305, Rev. 3)
(19B226633, Sh. 2, Rev. 1)
(19B226633, Sh. 3, Rev. 1)



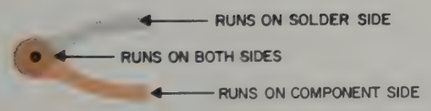


(19C327307, Rev. 1)

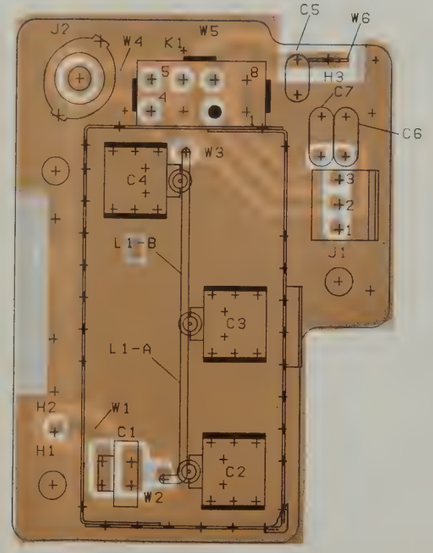




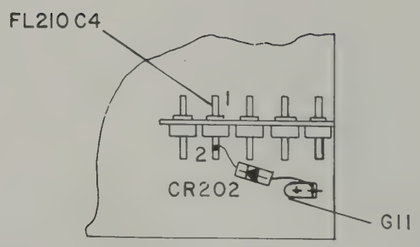
FROM	TO	WIRE	REMARKS
			——
H9	H10	DA	——
H11	H12	DA	SLV



FILTER BOARD

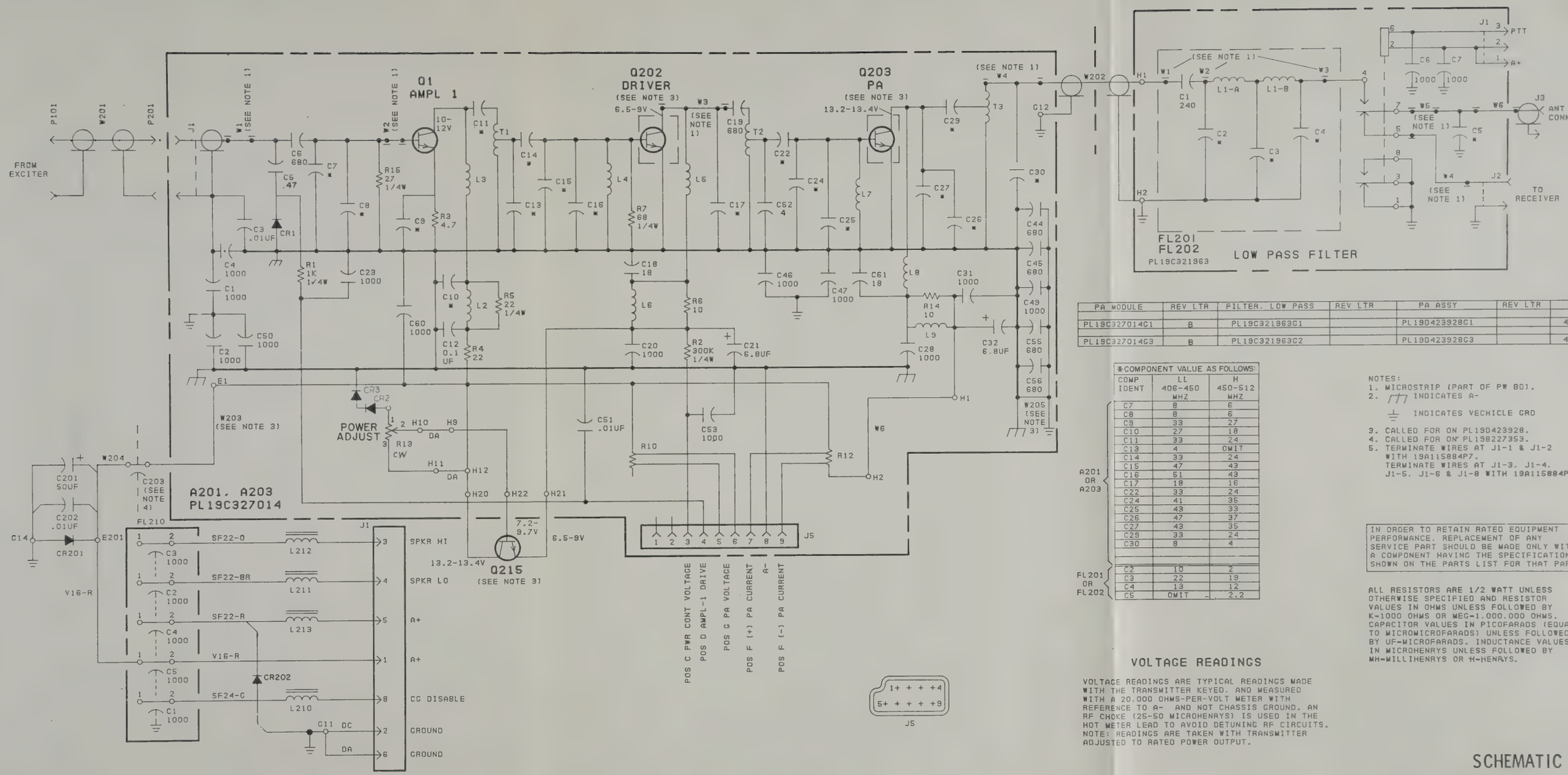


(19C327137, Rev. 1)
(19B227225, Sh. 2, Rev. 0)
(19B227225, Sh. 3, Rev. 0)



OUTLINE DIAGRAM

406—420 & 450—512 MHz
POWER AMPLIFIER



PA MODULE	REV LTR	FILTER, LOW PASS	REV LTR	PA ASSY	REV LTR	FREQ
PL19C327014G1	B	PL19C321963G1		PL19D423928G1		406-450 MHZ
PL19C327014G3	B	PL19C321963G2		PL19D423928G3		450-512 MHZ

*COMPONENT VALUE AS FOLLOWS:

	COMP IDENT	LL 406-450 MHZ	H 450-512 MHZ
A201 OR A203	C7	8	6
	C8	8	6
	C9	33	27
	C10	27	18
	C11	33	24
	C13	4	OMIT
	C14	33	24
	C15	47	43
	C16	51	43
	C17	18	16
	C22	33	24
	C24	41	35
	C25	43	33
	C26	47	37
	C27	43	35
	C29	33	24
	C30	8	4
FL201 OR FL202	C2	10	2
	C3	22	18
	C4	13	12
	C5	OMIT	2.2

NOTES:
1. MICROSTRIP (PART OF PW BD).
2. ⫽ INDICATES A-
   ⏚ INDICATES VECHICLE GRD
3. CALLED FOR ON PL19D423928.
4. CALLED FOR ON PL19B227353.
5. TERWINATE WIRES AT J1-1 & J1-2 WITH 19A115884P7.
   TERWINATE WIRES AT J1-3. J1-4. J1-5. J1-6 & J1-8 WITH 19A115884P9.

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ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS.

VOLTAGE READINGS

VOLTAGE READINGS ARE TYPICAL READINGS MADE WITH THE TRANSMITTER KEYED. AND MEASURED WITH A 20,000 OHMS-PER-VOLT METER WITH REFERENCE TO A- AND NOT CHASSIS GROUND. AN RF CHOKE (25-50 MICROHENRYS) IS USED IN THE HOT METER LEAD TO AVOID DETUNING RF CIRCUITS. NOTE: READINGS ARE TAKEN WITH TRANSMITTER ADJUSTED TO RATED POWER OUTPUT.

(19R622229, Rev. 5)

SCHEMATIC DIAGRAM

406—420 & 450—512 MHz
POWER AMPLIFIER

PARTS LIST

LBI-30157A

406-420, 450-512 MHz POWER AMPLIFIER
19D423928G1 406-450 MHz
19D423928G3 450-512 MHz

SYMBOL	GE PART NO.	DESCRIPTION
A201 and A203		POWER AMPLIFIER MODULE A201 19C327014G1 406-450 MHz A203 19C327014G3 450-512 MHz
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1 and C2	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C3	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C4	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C5*	5491601P113	Phenolic: 0.47 pf ±10%, 500 VDCW.
		Earlier than REV A:
	19A116656P3J0	Ceramic disc: 3 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C6	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C7LL	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C7M	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C8LL	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C8M	19A116656P6J0	Ceramic disc: 6 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C9LL	7489162P15	Silver mica: 33 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C9M	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C10LL	7489162P13	Silver mica: 27 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C10M	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C11LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C11M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C12	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C13	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C14LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C14M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C15LL	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW.
C15M	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C16LL	19A116952P51	Metallized teflon: 51 pf ±2%, 250 VDCW.
C16M	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C17LL	19A116679P18D	Metallized teflon: 18 pf ±.5 pf, 250 VDCW.
C17M	19A116679P16D	Metallized teflon: 16 pf ±.5 pf, 250 VDCW.
C18	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
C19	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C20	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C21	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C22LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C22M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C23	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C24LL	19A116952P41	Metallized teflon: 41 pf ±2%, 250 VDCW.
C24M	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW.
C25LL	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C25M	19A116952P33	Metallized teflon: 33 pf ±2%, 250 VDCW.
C26LL	19A116952P47	Metallized teflon: 47 pf ±2%, 250 VDCW.
C26M	19A116952P37	Metallized teflon: 37 pf ±2%, 250 VDCW.
C27LL	19A116952P43	Metallized teflon: 43 pf ±2%, 250 VDCW.
C27M	19A116952P35	Metallized teflon: 35 pf ±2%, 250 VDCW.
C28	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C29LL	19A116656P33J0	Ceramic disc: 33 pf ±5%, 500 VDCW, temp coef 0 PPM.
C29M	19A116656P24J0	Ceramic disc: 24 pf ±5%, 500 VDCW, temp coef 0 PPM.
C30LL	19A116656P8J0	Ceramic disc: 8 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C30M	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C31	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C32	19A134202P15	Tantalum: 6.8 µf ±20%, 35 VDCW.
C44 and C45	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C46 and C47	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C49 and C50	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C51	19A116192P1	Ceramic: 0.01 µf ±20%, 50 VDCW; sim to Erie 8121 SPECIAL.
C52LL	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C52M	19A116656P4J0	Ceramic disc: 4 pf ±0.5 pf, 500 VDCW, temp coef 0 PPM.
C53	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C55 and C56	19A116655P18	Ceramic disc: 680 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C60	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
C61	7489162P9	Silver mica: 18 pf ±5%, 500 VDCW; sim to Electro Motive Type DM-15.
		- - - - - - - - DIODES AND RECEPTACLES - - - - -
CR1	19A116052P1	Diode, silicon.
CR2* and CR3*	19A115250P1	Silicon. Added by REV B.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E1	19A134263P1	Contact, electrical: sim to Selectro X-L-070174-1.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
J5	19B219374G1	Connector: 9 contacts.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L2	19A129773G1	Coil.
L3	19A129774P1	Coil.
L4	19A129773G1	Coil.
L5	19B219457P6	Coil.
L6	7488079P40	Choke, RF: 5.60 µh ±10%, 0.15 ohms DC res max; sim to Jeffers 4422-1.
L7	7488079P13	Choke, RF: 5.60 µh ±10%, 0.30 ohms DC res max; sim to Jeffers 4421-4.
L8LL	19B219457P6	Coil.
L8M	19A130650P1	Coil.
L9	19A129773G1	Coil.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A134237P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1LL	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R1M	3R152P102J	Composition: 1000 ohms ±5%, 1/4 w.
R2LL	3R152P304J	Composition: 300,000 ohms ±5%, 1/4 w.
R2M	3R152P304J	Composition: 300,000 ohms ±5%, 1/4 w.
R3	7147161P13	Composition: 4.7 ohms ±5%, 1/2 w.
R4	3R77P220J	Composition: 22 ohms ±5%, 1/2 w.
R5	3R152P220J	Composition: 22 ohms ±5%, 1/4 w.
R6	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R7	3R152P680J	Composition: 68 ohms ±5%, 1/4 w.
R10	19C320212P1	Shunt resistor.
R12	19C320212P1	Shunt resistor.
R13	19A116559P102	Variable, cermet: 5000 ohms ±20%, .5 w; sim to CTS Series 360.
R14	3R77P100J	Composition: 10 ohms ±5%, 1/2 w.
R15	3R152P270J	Composition: 27 ohms ±5%, 1/4 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - -
T1 thru T3	19A130446P1	Coil.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 thru W4		(Part of printed board 19D423005P1).
W6	19B226971G1	Jumper.
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C201	19A115680P4	Electrolytic: 50 µf +150% -10%, 25 VDCW; sim to Mallory Type TTX.
C202	19A116080P101	Polyester: 0.01 µf ±10%, 50 VDCW.
C203	19B209488P2	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Style FA5D.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR201	19A116783P1	Silicon.
CR202	4037822P1	Silicon.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
E201	7143206P1	Terminal, standoff.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL201 and FL202		FILTER BOARD FL201 19C321963G1 406-450 MHz (LL) FL202 19C321963G2 450-512 MHz (H)
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	19A116679P240J	Silver mica: 240 pf ±5%, 250 VDCW.
C2LL	19A116952P10	Metallized teflon: 10 pf ±0.5 pf, 250 VDCW.
C2H	19A116952P9	Metallized teflon: 9 pf ±0.5 pf, 250 VDCW.
C3LL	19A116952P22	Metallized teflon: 22 pf ±0.5 pf, 250 VDCW.
C3H	19A116952P20	Metallized teflon: 20 pf ±0.5 pf, 250 VDCW.
C4LL	19A116952P13	Metallized teflon: 13 pf ±0.5 pf, 250 VDCW.
C4H	19A116952P12	Metallized teflon: 12 pf ±0.5 pf, 250 VDCW.
C5H	19A134100P20	Ceramic: 2.2 pf ±0.1 pf, 100 VDCW.
C6 and C7	19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
J2	19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19B209558P1	Hermetic sealed: 180 to 330 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L1LL	19B227240P1	Jumper.
L1H	19B227240P2	Jumper.
		- - - - - - - - - - CABLES - - - - - - - - - -
W1 thru W5		(Part of printed board 19C321962P1).
W6	19A136512P1	Antenna strap.
		- - - - - - - - - - FILTERS - - - - - - - - - -
FL210		FILTER 19A136680G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 thru C5	5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
		- - - - - - - - - - TERMINALS - - - - - - - - - -
G11 and G12	7135118P2	Terminal, solderless.
G14	7135118P2	Terminal, solderless.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1		Connector. Includes:
	19A115884P12	Shell.
	19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1.
	19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1.
J3	4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-798.
		- - - - - - - - - - INDUCTORS - - - - - - - - - -
L210 thru L213	19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
		- - - - - - - - - - PLUGS - - - - - - - - - -
P201		(Part of W201).
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q202	19A134164P2	Silicon, NPN; sim to Type 2N5945.
Q203LL	19A134171P4	Silicon, NPN.
Q203M	19A134239P2	Silicon, NPN.
Q215	19A116742P1	Silicon, NPN.
		- - - - - - - - - - CABLES - - - - - - - - - -
W201	5491689P91	Cable, RF: approx 7-1/2 inches long.
W202	19A136529G1	Cable: approx 4 inches long.
W203	19C327146P1	Jumper.
W204	19C327146P2	Jumper.
W205	7135118P1	Terminal, solder.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	19C321982P1	Insulator. (Located under A201 and A203).
	19B227353G1	Shield. (Located around A201, A203).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures shield to frame at C17).
	19B209209P305	Tap screw, Phillips Pozidriv®: No. 6-32 x 5/16. (Secures shield to frame at J5).
	5492178P2	Washer, spring tension. (Used with Q202).
	N207P15C6	Hex nut: No. 8-32. (Used with Q202).
	19A130465P1	Spacer. (Used with Q202).
	N44P9006C6	Screw, machine: No. 4-40 x 3/8. (Secures Q203).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL201 and FL202).
	19B209209P304	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/4. (Secures FL210).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	4036555P1	Insulator, washer: nylon. (Used with Q1).
	19B219554G2	Can. (FL201, FL202).
	19B219555P1	Cover. (FL201, FL202).
	19B209502P1	Terminal, stud. (Used with C2, C3, C4, L1).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Power Amplifier Module 19C327014G1,3
To increase power output at high end. Changed C5.

REV. B - To increase power output at cold temperatures.
Added CR2 and CR3.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

GE PART NO.	DESCRIPTION
19A134100P20	Ceramic: 2.2 pf ±0.1 pf, 100 VDCW.
19A116655P20	Ceramic disc: 1000 pf ±10%, 1000 VDCW; sim to RMC Type JF Discap.
	- - - - - - - - JACKS AND RECEPTACLES - - - - - -
19A116659P55	Connector, printed wiring: 3 contacts; sim to Molex 09-65-1031.
19A130924G1	Connector, coaxial: jack type; sim to Cinch 14H11613.
	- - - - - - - - - - - - RELAYS - - - - - - - - - - -
19B209558P1	Hermetic sealed: 180 to 330 ohms coil res, 2 form C contacts, 8.0 to 16.3 VDC; sim to GE 3SAV1760A2.
	- - - - - - - - - - - INDUCTORS - - - - - - - - - - -
19B227240P1	Jumper.
19B227240P2	Jumper.
	- - - - - - - - - - - - CABLES - - - - - - - - - - -
	(Part of printed board 19C321962P1).
19A136512P1	Antenna strap.
	- - - - - - - - - - - FILTERS - - - - - - - - - - -
	FILTER 19A136680G1
	- - - - - - - - - - - CAPACITORS - - - - - - - - - -
5493392P7	Ceramic, feed-thru: 1000 pf +100% -0%, 500 VDCW; sim to Allen-Bradley Type FA5C.
	- - - - - - - - - - TERMINALS - - - - - - - - - - -
7135118P2	Terminal, solderless.
7135118P2	Terminal, solderless.
	- - - - - - - - JACKS AND RECEPTACLES - - - - - -
	Connector. Includes:
19A115884P12	Shell.
19A115884P7	Contacts, male: wire size 14-20; sim to AMP 60528-1.
19A115884P9	Contacts, male: wire size 22-30; sim to AMP 60910-1.
4029493P1	Connector, receptacle: coaxial; sim to Amphenol 83-798.
	- - - - - - - - - - - INDUCTORS - - - - - - - - - -
19A126140P3	Core, toroidal, ferrite: sim to Stackpole 88-31959.
	- - - - - - - - - - - PLUGS - - - - - - - - - - -
	(Part of W201).
	- - - - - - - - - - - TRANSISTORS - - - - - - - - -
19A134164P2	Silicon, NPN; sim to Type 2N5945.
19A134171P4	Silicon, NPN.
19A134239P2	Silicon, NPN.
19A116742P1	Silicon, NPN.
	- - - - - - - - - - - - CABLES - - - - - - - - - - - -
5491689P91	Cable, RF: approx 7-1/2 inches long.
19A136529G1	Cable: approx 4 inches long.
19C327146P1	Jumper.
19C327146P2	Jumper.
7135118P1	Terminal, solder.

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19C321982P1	Insulator. (Located under A201 and A203).
	19B227353G1	Shield. (Located around A201, A203).
	19B201074P304	Tap screw, Phillips POZIDRIV®: No. 6-32 x 1/4. (Secures shield to frame at C17).
	19B209209P305	Tap screw, Phillips Pozidriv®: No. 6-32 x 5/16. (Secures shield to frame at J5).
	5492178P2	Washer, spring tension. (Used with Q202).
	N207P15C6	Hex nut: No. 8-32. (Used with Q202).
	19A130465P1	Spacer. (Used with Q202).
	N44P9006C6	Screw, machine: No. 4-40 x 3/8. (Secures Q203).
	19A116023P1	Insulator, plate. Dupont No. 300 Kapton H. (Located under Q215).
	19A134016P1	Insulator, bushing. (Used with Q215).
	7878243P11	Hex nut: No. 8-32. (Secures stud that mates with wing nut securing radio to case).
	4033714P11	Terminal, solderless: sim to Zierick 349. (Solders to FL201 and FL202).
	19B209209P304	Tap screw, Phillips Pozidriv®: No. 6-32 x 1/4. (Secures FL210).
	19B201074P204	Tap screw, Phillips POZIDRIV®: No. 4-40 x 1/4. (Secures J3).
	4036555P1	Insulator, washer: nylon. (Used with Q1).
	19B219554G2	Can. (FL201, FL202).
	19B219555P1	Cover. (FL201, FL202).
	19B209502P1	Terminal, stud. (Used with C2, C3, C4, L1).

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - Power Amplifier Module 19C327014G1,3
To increase power output at high end. Changed C5.

REV. B - To increase power output at cold temperatures. Added CR2 and CR3.

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and GE Part Number.

Service parts may be obtained from Authorized GE Communication Equipment Service Stations or through any GE Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. GE Part Number for component
2. Description of part
3. Model Number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

DF-3166

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

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ATTENTION General - Electric - UHF - Custom - MVP Users!

Are you Interested In A Quality, Low-Cost Repeater?

ALSO available for Exec II, dual Phoenix and others. . . .

New miniature version at low price

Announcing The RP3 Modification Kit

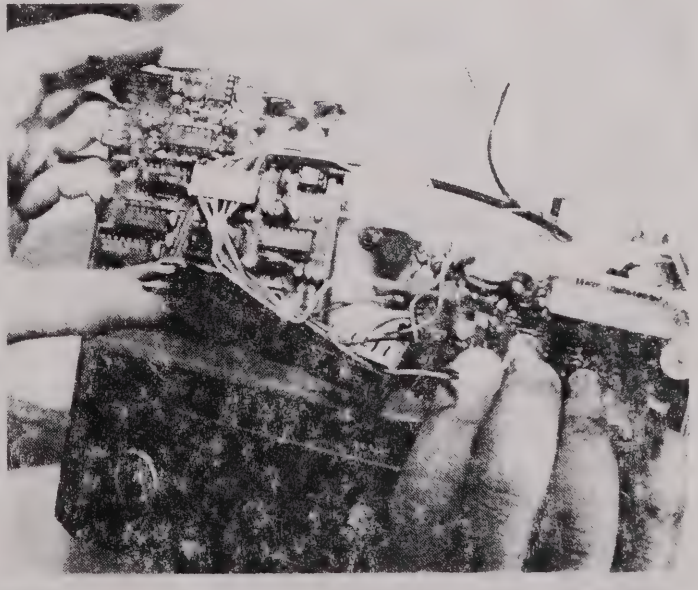
What does it do? This modification:

- converts your G.E. UHF custom MVP* 2-Way Mobile Radio into a repeater station
- leaves all normal radio functions and controls to operate essentially as before, CTCSS protected
- allows easy interface with remote-control unit, desk mic option, and half-duplex phone patch

What do I get in the Kit? The RP3 kit includes:

- Repeater-Control/encode/decode board with all interconnections
- receiver input cable
- phone-patch interconnection cable
- complete installation instructions and tech manual with diagrams

The kit does not include duplexer nor ICOM's



How do I install it? Very easily:

- replace the Channel-Guard board** with the Repeater-Control/encode/decode board supplied in kit
- add r-f cable, supplied in kit, to connect receiver directly to your duplexer
- change ICOM's to reverse TX/RX frequencies

---

*Radio must have 2 PPM oscillator stability to comply with F.C.C repeater requirements (use "B" in 10th digit of G.E. order#)

**If ordering a new MVP for this repeater service, order it without the CG Board. (use "S" in 7th digit of G.E. order #)

Let's see the specs! RP3 performance ratings:

- CTCSS decoder sensitivity = .1 KHz minimum deviation CTCSS tone for repeater access
- tone selection: user-programmed on DIP switch for any one of 32 standard CTCSS frequencies
- repeat-mode audio squelching: controlled by carrier activated squelch (CAS) and tone operated squelch (TOS) for minimal squelch tail
- drop-out timer duration: adjustable 2½ to 5 seconds (time from end of received, decoded signal till transmitter drops out), which may be increased by customer-installed resistor
- time-out timer duration: 2½ minutes ± ½ minute (time limit of uninterrupted repeat transmission)
- power requirements: drains 90 ma from radio's 13.5 volt supply line
- phone patch interface thru six leads, including conditioned RX-audio line that bypasses volume control

What does the kit cost? Effective 1/1/84

Repeater-modification kits, single tone, fit in radio cabinet:

RP3	for MVP, includes: RP3A circuit board with TSU-32 tone module, cable harness, RX rf cable, complete installation instructions with diagrams	$365.00
RP32	for Exec II station, includes: RP 32A circuit board with mounting bracket and TSU-32 tone module, cable harness, RX rf cable, complete installation instructions with diagrams*	$390.00
RP11 mini-version	for two MLS or Phoenix radios (adaptable for others), includes: 1.45" x3.3" circuit board with insulation-tube covering (fits inside Rx radio), cable harness to mate with radio rear connectors, complete installation instructions with diagrams**	$148.00

Building blocks for multitone expansion (for Community/shared-repeater):

MT6	six-tone-expansion circuit board with cable, less tone modules	$150.00
CM12	cabinet to house one or two MT6 circuit boards, 20 gauge steel, 9½"x5"x2", painted to match MVP cabinet, holes cut, board-mounting hardware provided (not needed for Exec II station)	$40.00
TSU-32***	CTCSS encode/decode tone module, DIP-switch programmable, for MT6 circuit boards, one required for each tone-channel expansion used beyond single tone (one provided on RP3A board)	$59.95

PARKINSON ELECTRONICS COMPANY

P.O. Drawer B 1515 Houston St.
Levelland, Texas 79336
(806) 894-1576

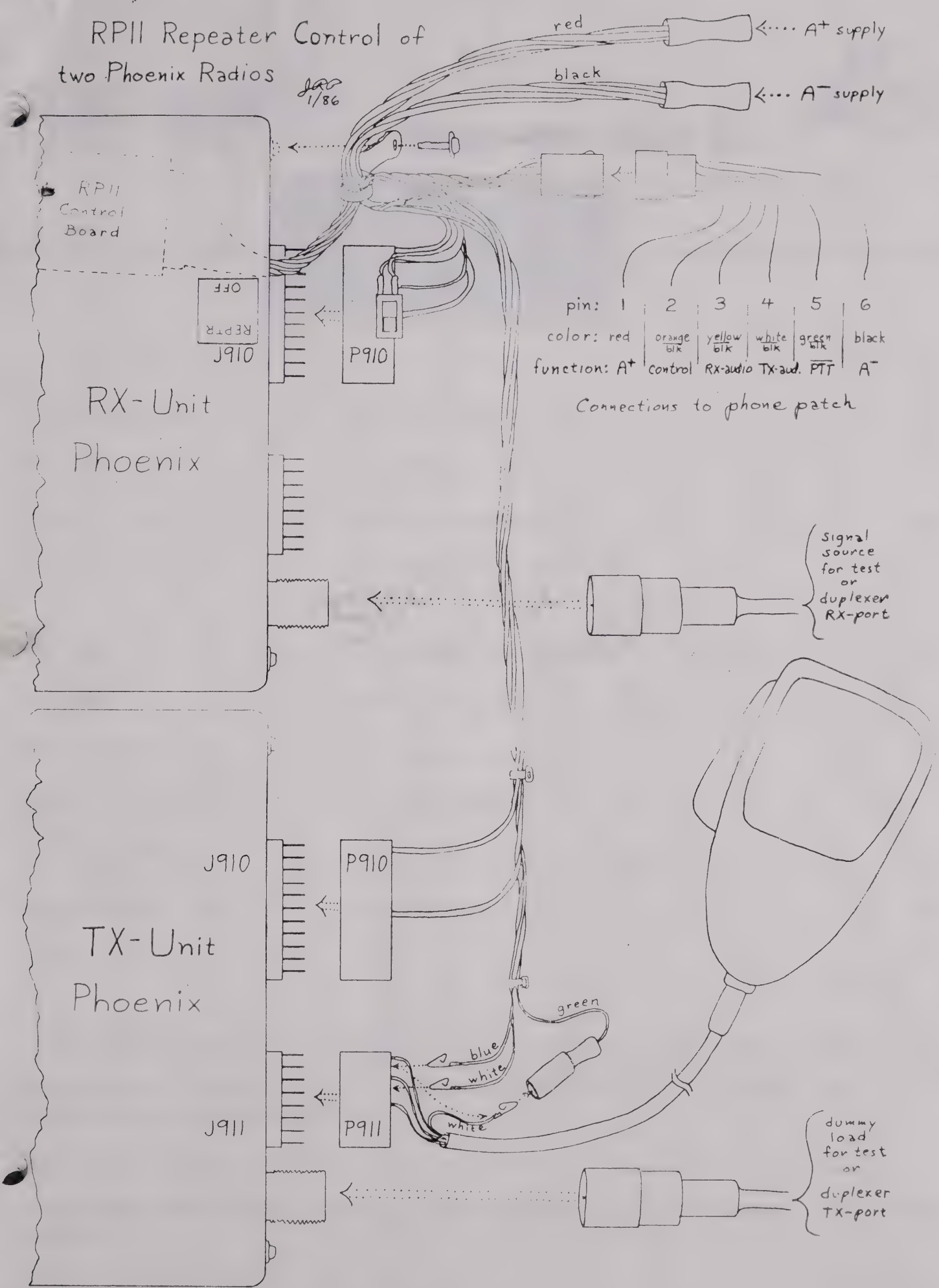
*Use 2 PPM TX-ICOM and 5 PPM RX-ICOM

**With Phoenix SX wideband, we recommend using Celwave PD6336A duplexer or equivalent. Order radios with 2.5 PPM by changing final digit of combination number from "B" to "A"

***The TSU 32 is a product of Communications Specialists Inc., Orange, California

RPII Repeater Control of two Phoenix Radios

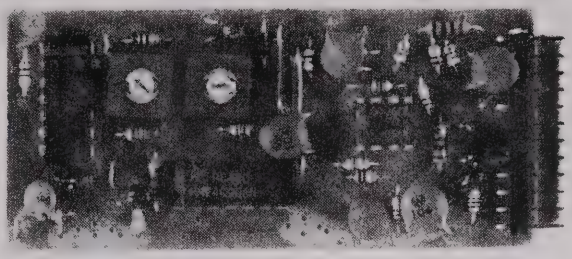
JRC 1/86



THE RP11 Repeater Mod Kit

PARKINSON
ELECTRONICS
COMPANY
806/894-1578

lade for two Phoenix radios



has also been adapted to these radios

G.E. MLS or Phoenix S or SX	(two radios required)	$146
G.E. Mastr II Mobile	(one radio required)	$220
	rf cable option ...	$ 15
G.E. CMX	(two radios required)	$148
*Midland 70-565	(two radios required)	$125

Radios that have been **studied** for RP11 application

G.E. MVP	(one radio required, decode only for HAM USE)	$165
	rf cable included	
*G.E. Exec II	(one radio required, decode only for HAM USE)	$150
*Midland 70-series	(two radios required)	$125
*Fujitsu	(two radios required)	$125
Kenwood TK801S	(two radios required, no 2.5 PPM option available)	$148
*Motorola Micor, hi-band	(one radio required)	$135
*Johnson PPL-6060	(one radio required)	$135

For each listed radio application the modification kit includes: the appropriately-adapted board (1.45" X 3.3" covered in clear insulation tubing), wiring-attachment diagrams for the specific radio, and wiring harness fitted with connectors for the specific radio, except where noted (*) otherwise. When ordering please specify radio type to be modified.

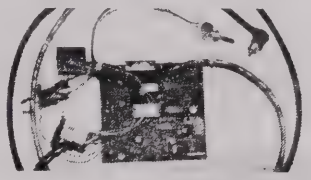
---

*Wiring harness for this radio has 2-foot-long color-coded wires to be cut-to-fit by installer, using diagrams provided in kit.

Mobile Radio
ACCESSORIES
from
Parkinson Electronics Company

Dealer Price in Unit Quantity

RP3 modification kit to REPEATER-IZE the GE MVP mobile radio; includes RP3A control board (mounts in place of CG-bd.) with TSU-32 CTCSS tone module, cable harness, RX rf cable, patch cable, complete installation instructions with diagrams (MT6 multitone option available). **$365.00**

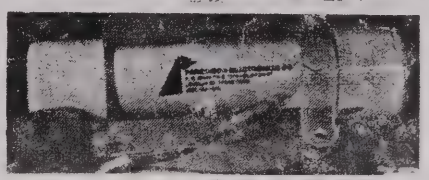


RP32 modification kit to REPEATER-IZE the GE Exec II Station; similar to RP3 above, but with mounting bracket, special harness, and parts values changed. **$390.00**

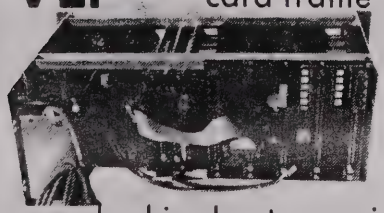
RP11 modification kit to REPEATER-IZE two GE MLS or Phoenix SX radios **$148.00**

(versions available for other radios); includes 1.45" x 3.3" x .38" circuit board with insulation-tube covering (fits inside RX radio), cable harness to mate with radio rear connectors, patch- cable connection, complete installation instructions with diagrams (Digital Channel Guard/DCSS can be programmed into Phoenix SX).

PT2 accessory to AUTOMATICALLY SWITCH OFF a high-standby-current mobile radio to avoid draining the auto battery overnight; solid state (no relay) device packaged small, rugged, and sealable to mount under-dash or under-hood; jumper programmable for 1 to 31 hours; capable of handling 5 amps continuous, 12 amps intermittent, wired in series with A+ line; installation diagrams. **$38.00**



VEP card frame for REDUCING SIZE and cost of the V or V•E interconnect to the GE Marc™ V trunked 800 MHz repeater system; squeezes 28" rack height into 7"; includes power supply and back planes; just slide in your IDA cards. **$990.00**



HTV accessory to RE-TIME the HORN HONK sequence of the GE-Classic, Classic II, Centura, Corona mobile radios for 4 seconds delay, 2-second pulsing bursts recurring each 8 seconds for 30 seconds total; includes control board with jumper options, hardware to mount board inside radio, complete installation instructions with diagrams. **$22.50**

NEW PRODUCTS:

MP8 eight-area expansion kit, fits inside Corona or Classic 1, advanced and displayed by existing front panel. **$85.00**

TC1 test-cable "system plug" with handle and strain relief, for bench-test hook ups to Phoenix or C-series GE radios. **$36.00**

COMING PRODUCTS:

RA5 voice-labeled switch for remotely selecting areas on GE MARC control stations using standard remote-control panel and standard remote-control units, announces selection verbally. **$400.00**

CALL for SPEC SHEETS or VOLUME QUOTES
800/332-7003 ext. 307 ask for Jim or Janey

1-88

19C321016G3 Mic Conn.

PA 19D423927G1

LBI-30143 DF3166

J1 19A115884 P12 Shell Assy

19A115884 P9 Contacts. 10 pcs

P7-

TXD MVP SYSTEM BD.

U902

C-924 .47MF

—20MS— delay

└ .22 for 10ms? .33 for 15ms

50MS Rx Return delay

C-923 — 4.7MF

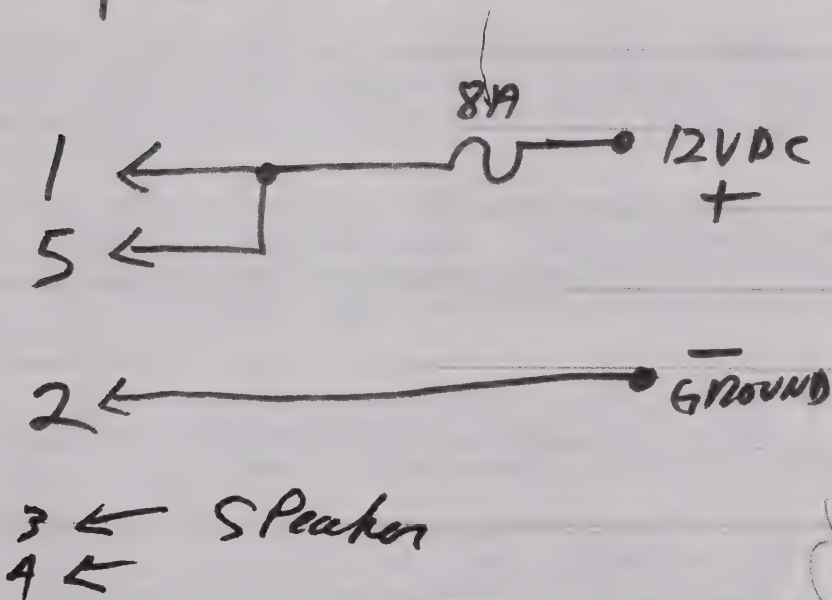
change to (1MF ?)

4.7 x 13K

6.1^{-02} = 60MS

1.3^{-02} = 13MS

MVP
Power Plugs



Chassis Shell 19A115 8P4P12
Contacts 19A115884PM

19A115884P11 shell ✓
19A115884P8 pins

MVP RADIO MODIFICATIONS FOR 9600 DATA MODEM.

June 29, 1993 by Walter Rheingans, N6LYF

These modifications give the following specifications.

Transmit modulation sensitivity: 4.0 volts peak-to-peak audio for 3.0 khz deviation. Frequency response is flat from 10 Hz to 8500 Hz.

Receive audio output: 3.0 khz incoming deviation results in 2.0 volts peak to peak audio output. Frequency response is good from 3 Hz to 7400 Hz.

A. Transmitter.

The transmitter is modified to modulate the crystal directly by means of the temperature compensating varicap diode in the crystal module unit that plugs into the exciter board.

1. On the transmitter exciter circuit board, add a 2.2 mf 25 volt capacitor across C-106. The purpose of this added cap is to prevent the modem modulation tone from modulating the receiver local oscillator thorough the compensation bus.

2. On the back of the crystal module, add a two post terminal strip by soldering the ground tab to the ground plane on the back of the module circuit board.

3. Construct a series circuit consisting of a 56 k ohm 1/8 watt resistor and a 2.2 mf tant. capacitor and solder the network from the varicap (cr-1) on the crystal module to the terminal strip. The (+) of the cap goes toward the varicap.

4. Add an .005 mf bypass cap to the terminal strip from the network (step 3-above) to the ground tab of the terminal strip.

5. Wire a shielded cable from the terminal strip and dress to the rear of the radio and exit through any convenient hole.

B. Receiver

The receiver is modified to increase the low frequency response of the detector output amplifier.

1. On the receiver IF-Detector board, change C-623 from 0.22 mf to 33 mf., and change C-627 from 22 mf to 470 mf. C-623 change extends the low frequency response of the output amplifier down to about 2 Hertz. With this change, it is essentially flat from 3 Hertz to 7400 Hertz. Increasing C-627 to 470 mf is to add low frequency stability to the amplifier power distribution bus.

2. Behind the front panel, at the system-audio board, connect the receiver audio output through a shielded cable connected at J-6 , #1 ground and # 4 audio high. J-6 is for connecting a CTCSS decoder and is not needed in this application, so solder directly to the pins of J-6.

3. Continue with the PTT connections below.

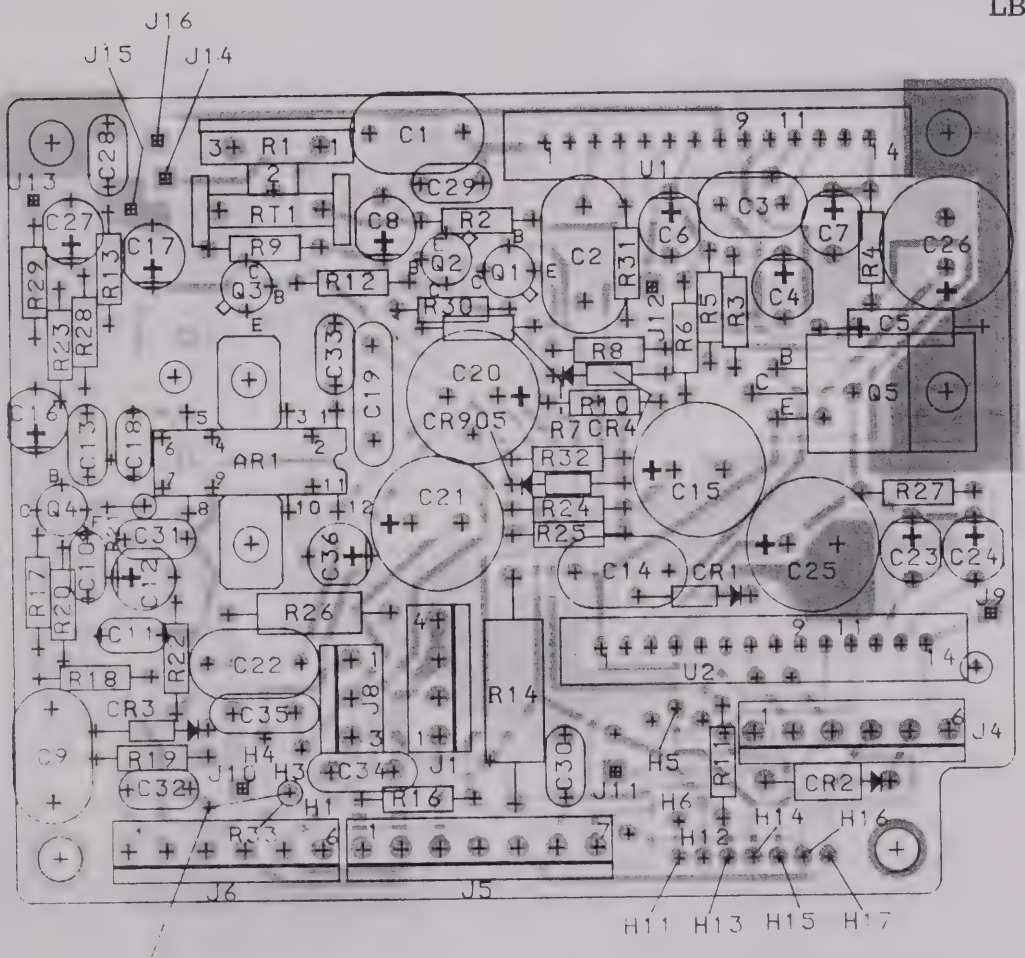
C. PTT Connection

1. While behind the front panel for the receive audio connections, connect a wire to hole H-17 on the system audio board to pick up the PTT connection.

2. Dress the PTT wire and receive audio wire along the edge of the radio with the existing radio wiring and take to a convenient exit at the rear of the radio with the transmit modulation wire.

D. Schematic Diagrams

Attached are diagrams showing the changes and, where possible, board layouts showing the component locations.

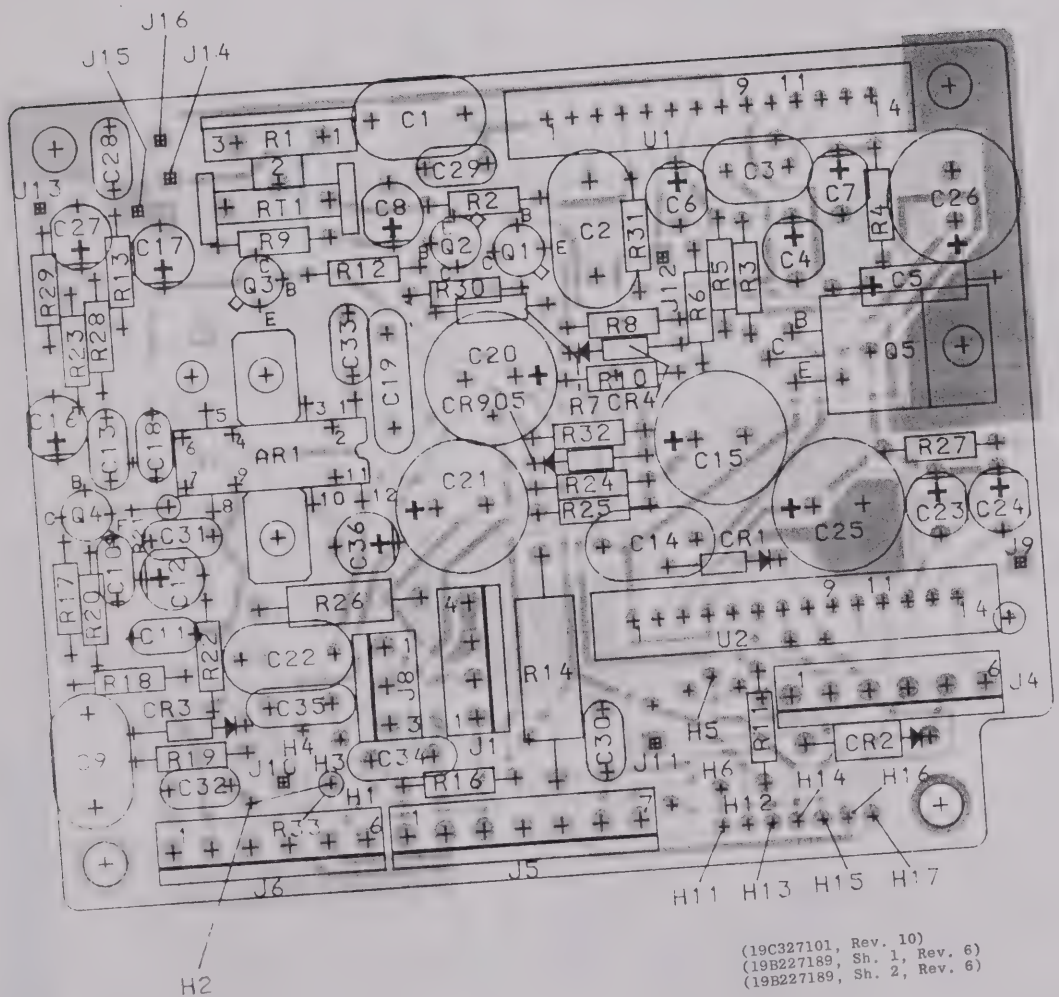


(19C327101, Rev. 10)
(19B227189, Sh. 1, Rev. 6)
(19B227189, Sh. 2, Rev. 6)

PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
FOR COMPLETE DESIGNATION PREFIX WITH 900 SERIES.
EXAMPLE: C1-C901 , R1-R901 , ETC.

LEAD IDENTIFICATION
FOR Q1-Q4

REFER TO WIRING DIAGRAM
19D423734 FOR THE



(19C327101, Rev. 10)
(19B227189, Sh. 1, Rev. 6)
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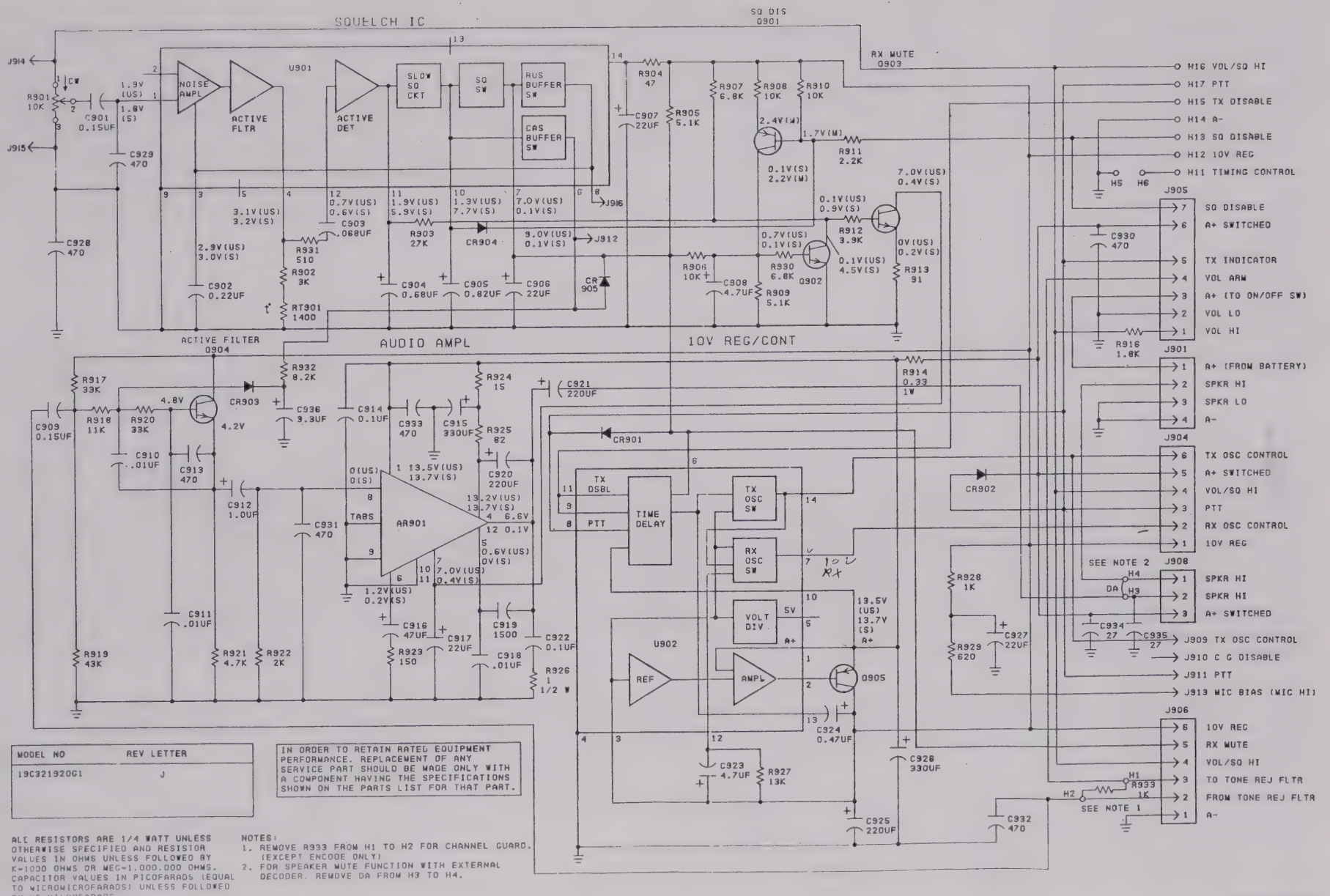
LEAD IDENTIFICATION
FOR Q1-Q4

FLAT B

REFER TO WIRING DIAGRAM
19D423734 FOR THE


SQUELCH IC
SQ DIS Q901
RX MUTE Q903
U901
NOISE AMPL
ACTIVE FLTR
ACTIVE DET
SLOW SQ CKT
SQ SW
RUS BUFFER SW
CAS BUFFER SW
ACTIVE FILTER Q904
AUDIO AMPL
10V REG/CONT
AR901
TIME DELAY
TX DSBL
PTT
TX OSC SW
RX OSC SW
VOLT DIV
REF
AMPL
U902
Q902
Q905
CR901
CR902
CR903
CR904
CR905
J901
J904
J905
J906
J908
J909 TX OSC CONTROL
J910 C G DISABLE
J911 PTT
J913 MIC BIAS (MIC HI)
H16 VOL/SQ HI
H17 PTT
H15 TX DISABLE
H14 A-
H13 SQ DISABLE
H12 10V REG
H11 TIMING CONTROL
SQ DISABLE
A+ SWITCHED
TX INDICATOR
VOL ARW
A+ (TO ON/OFF SW)
VOL LO
VOL HI
A+ (FROM BATTERY)
SPKR HI
SPKR LO
A-
TX OSC CONTROL
A+ SWITCHED
VOL/SQ HI
PTT
RX OSC CONTROL
10V REG
SPKR HI
SPKR HI
A+ SWITCHED
RX MUTE
VOL/SQ HI
TO TONE REJ FLTR
FROM TONE REJ FLTR
A-
SEE NOTE 1
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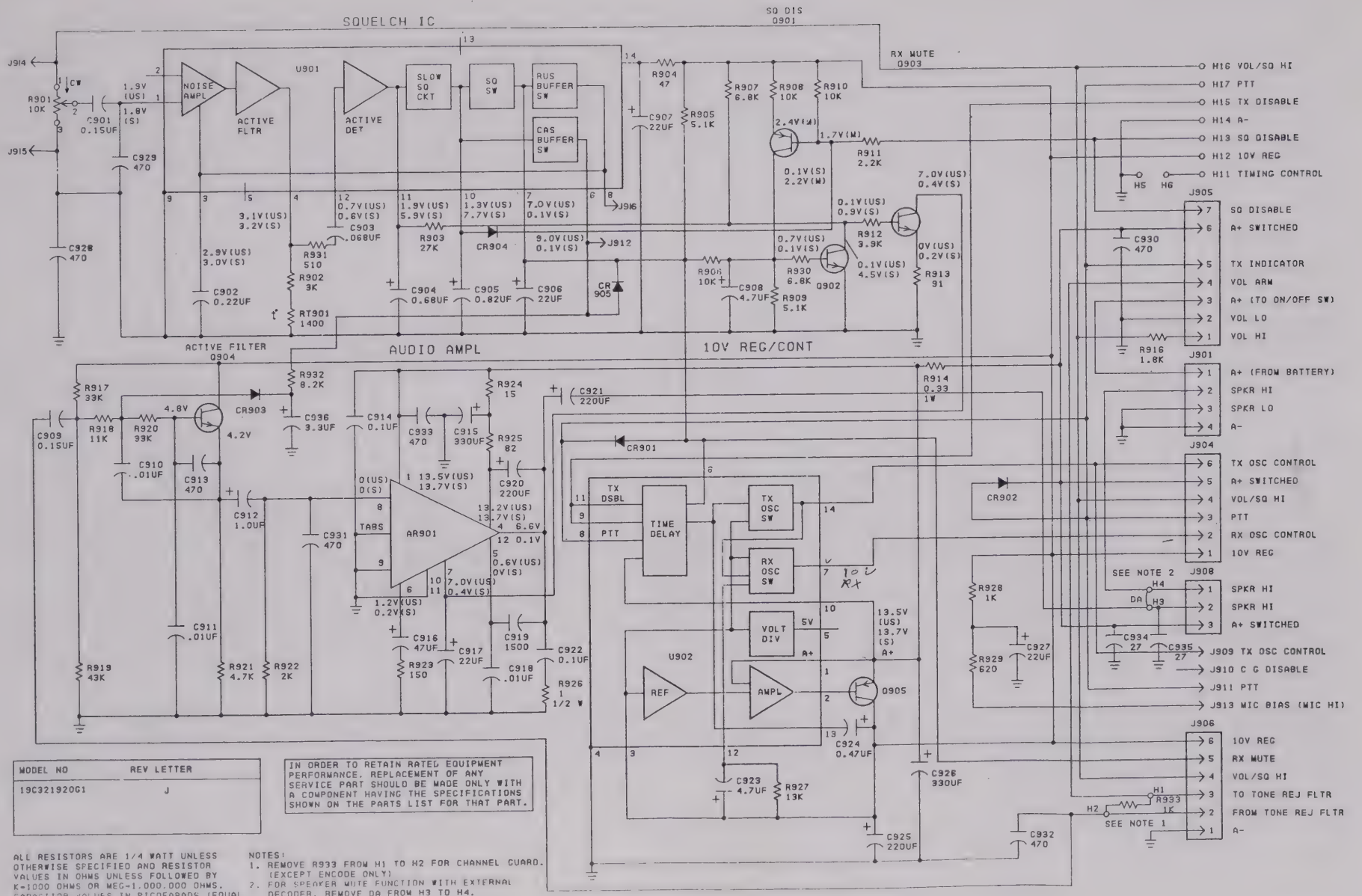
19C321920G1
J
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE. REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.
ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS.
NOTES:
1. REMOVE R933 FROM H1 TO H2 FOR CHANNEL GUARD. (EXCEPT ENCODE ONLY)
2. FOR SPEAKER MUTE FUNCTION WITH EXTERNAL DECODER. REMOVE DA FROM H3 TO H4.

SCHEMATI



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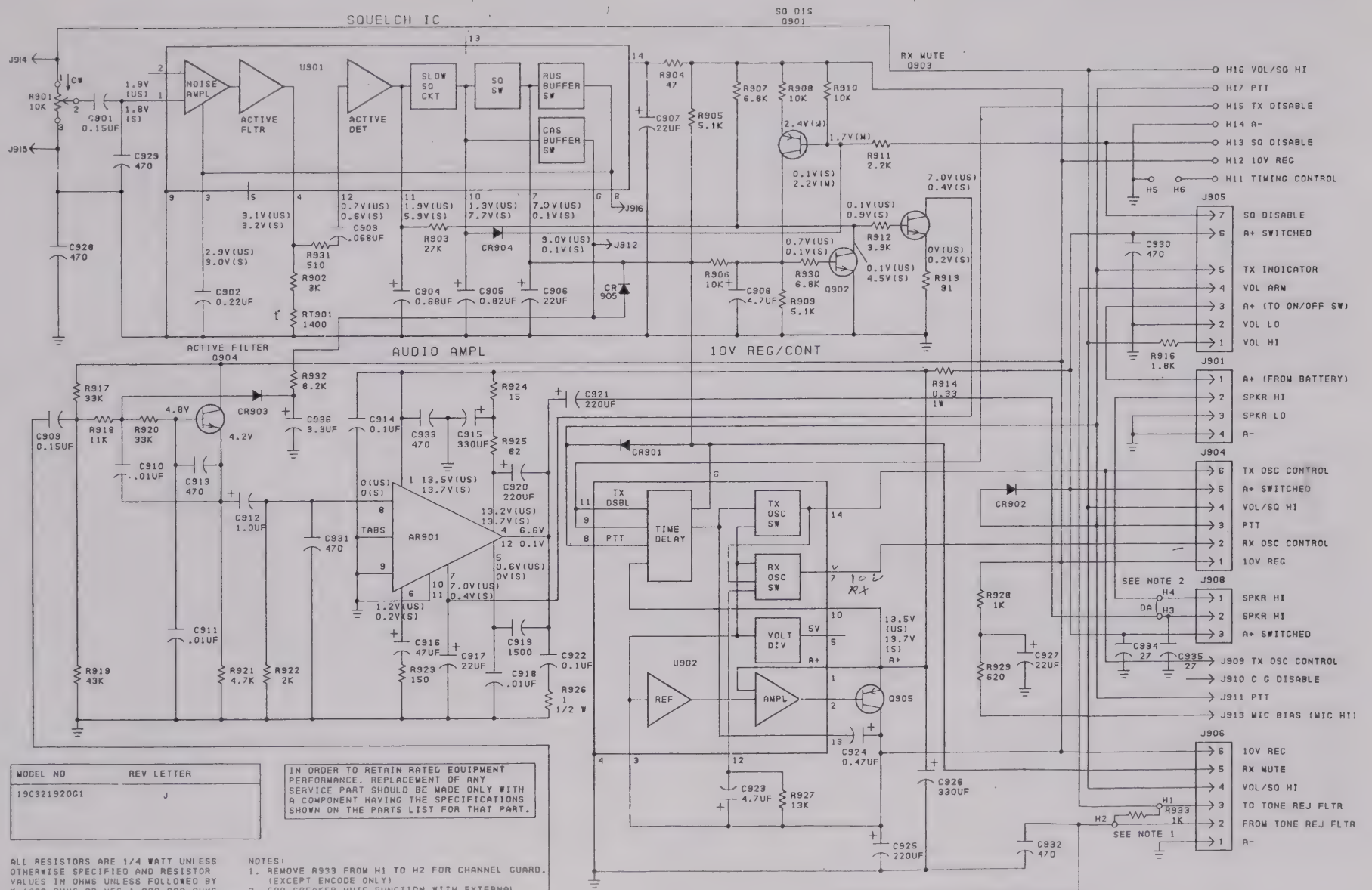

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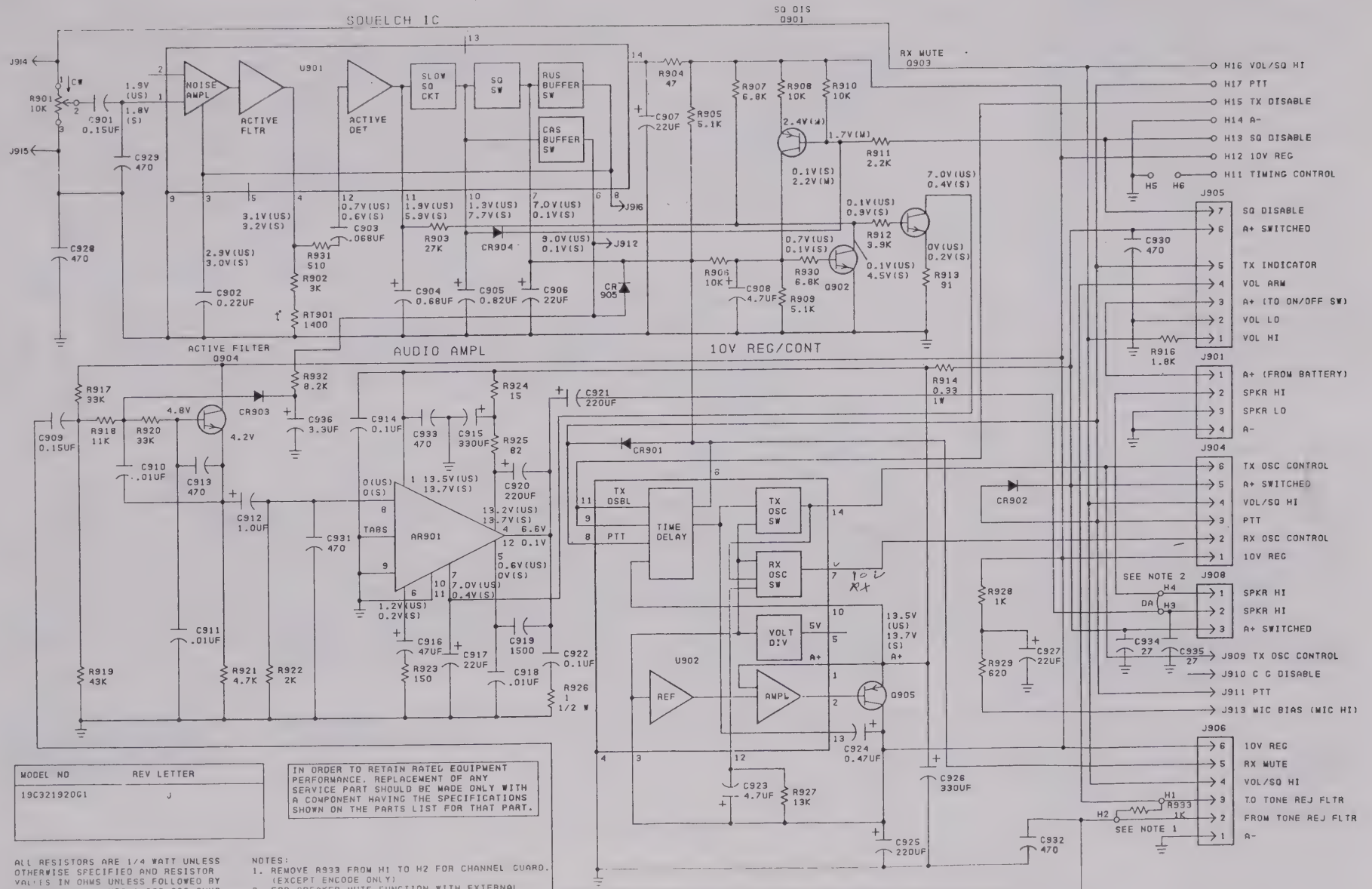

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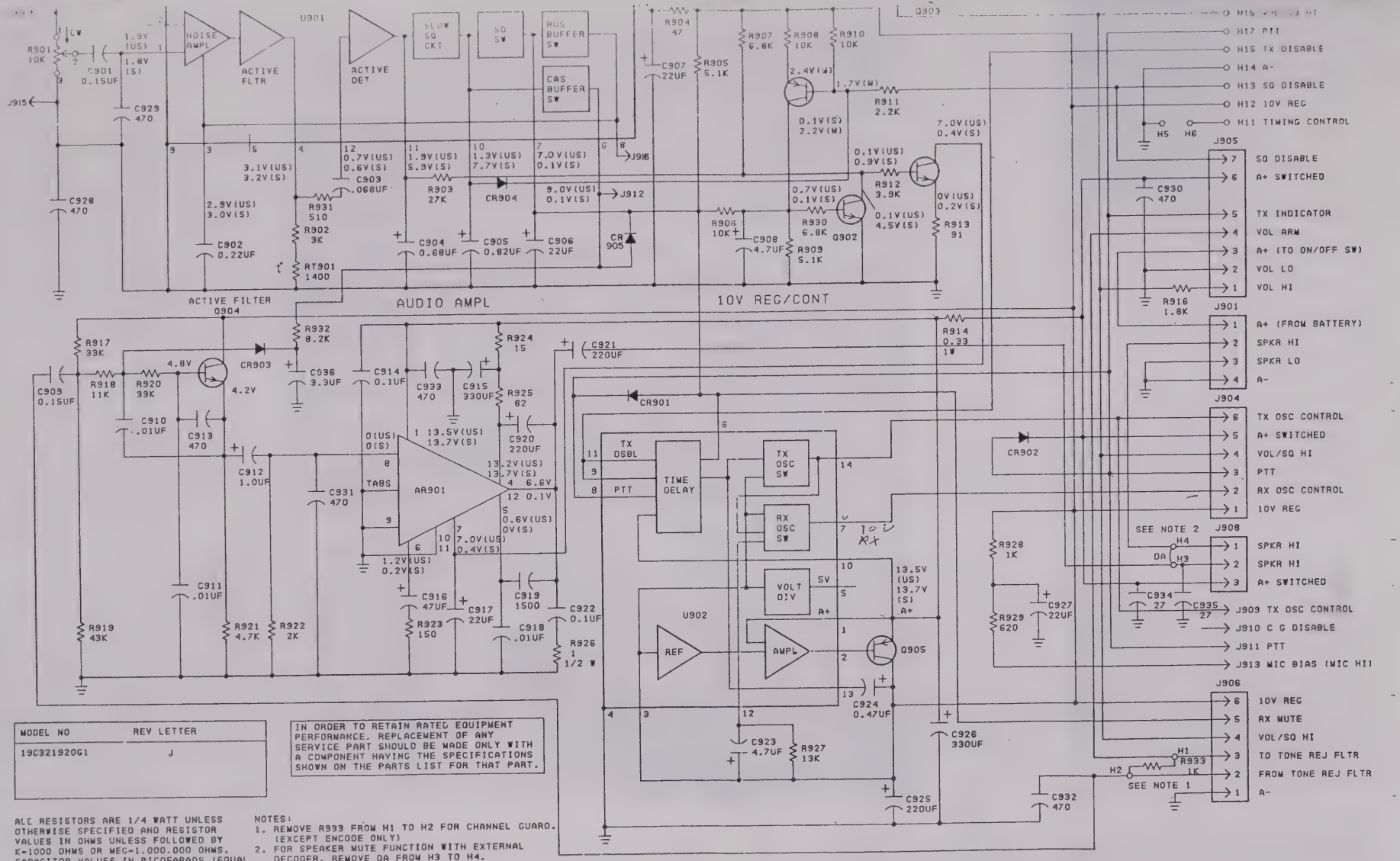
SCHEMATIC



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(19D423734, Rev. 10)

SCHEMATIC

SYSTEM-AUDIO-SQUI
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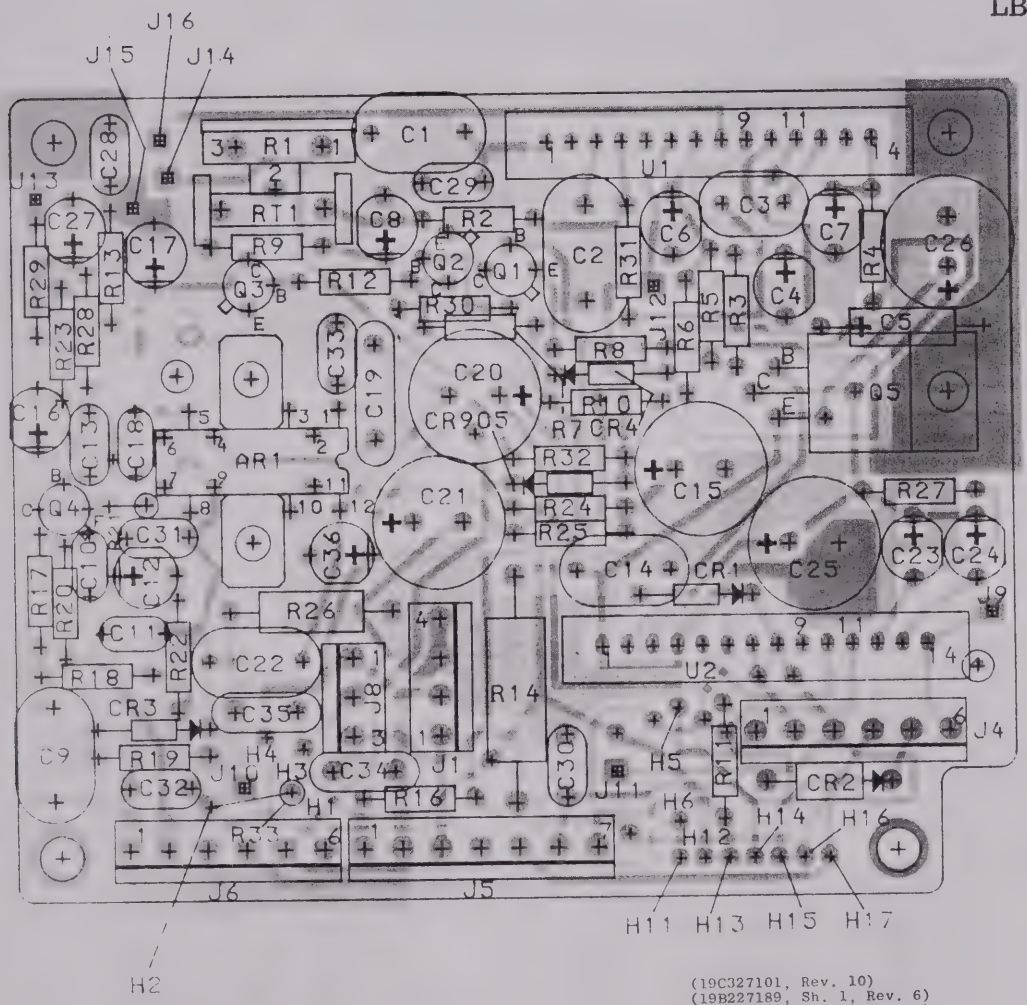
Issue 5



(19C327101, Rev. 10)
(19B227189, Sh. 1, Rev. 6)
(19B227189, Sh. 2, Rev. 6)

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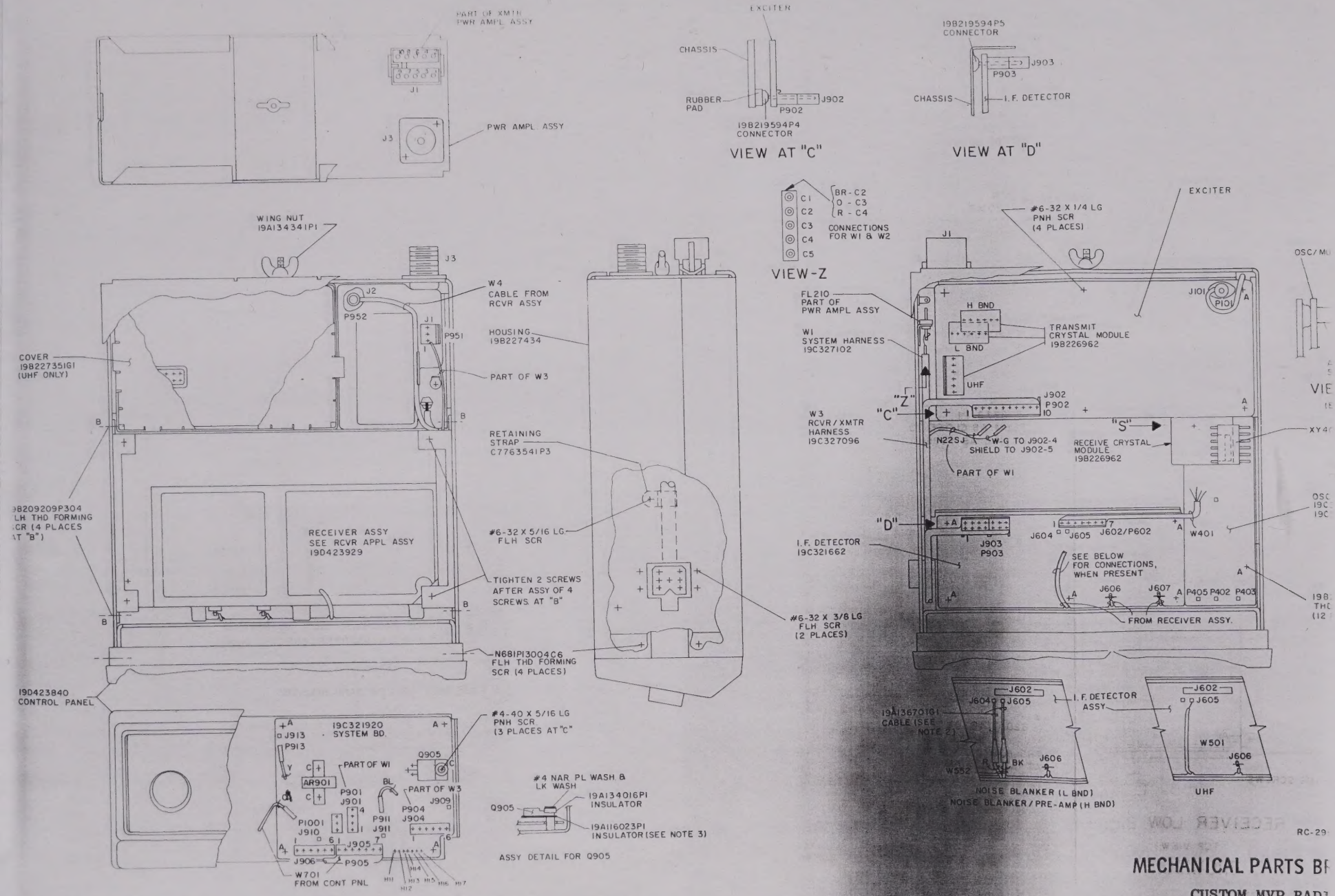

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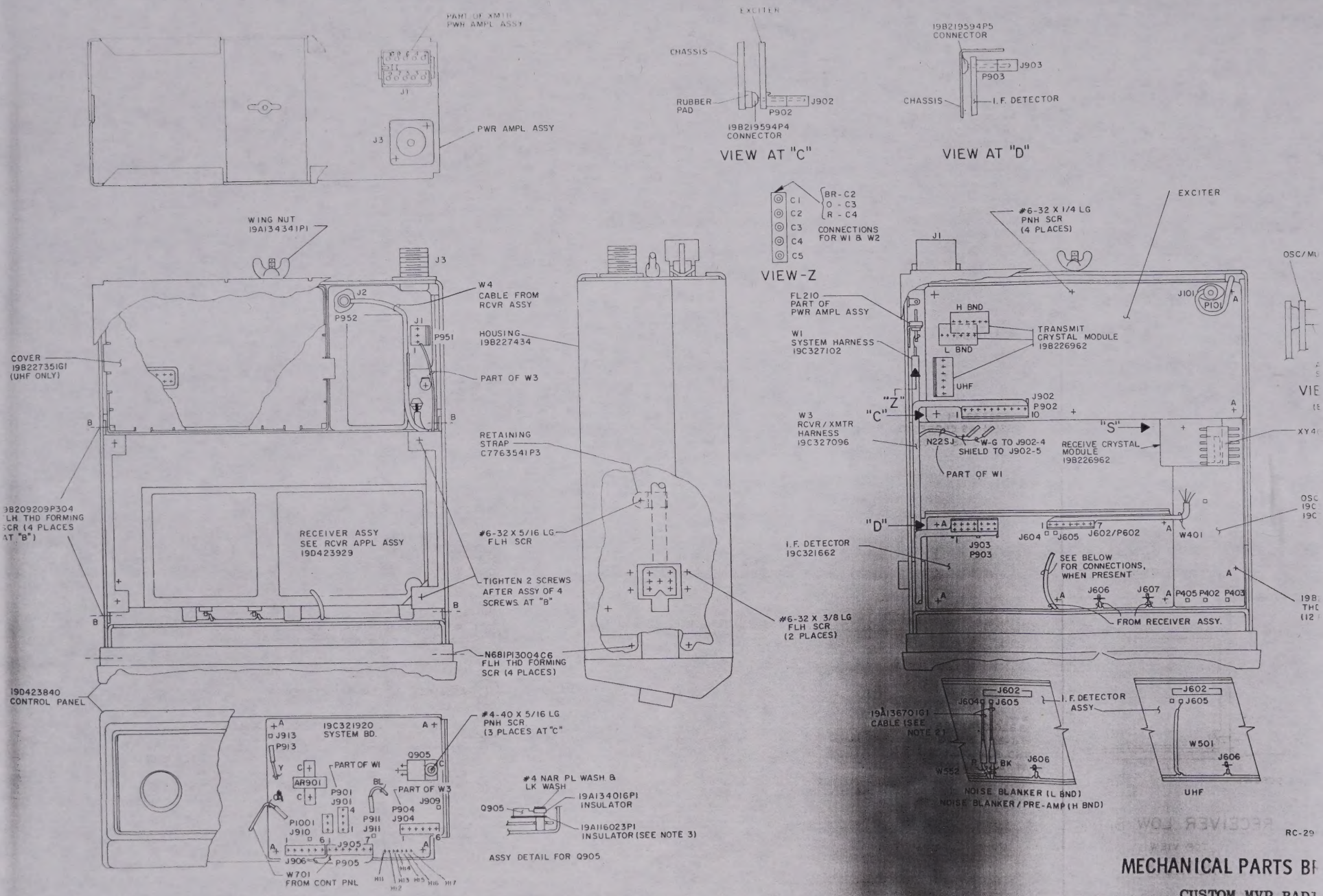
(19D423962, Sh. 2, Rev. 7)

RC-29

MECHANICAL PARTS BR

CUSTOM MVP RADI

Issue 3



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RC-29

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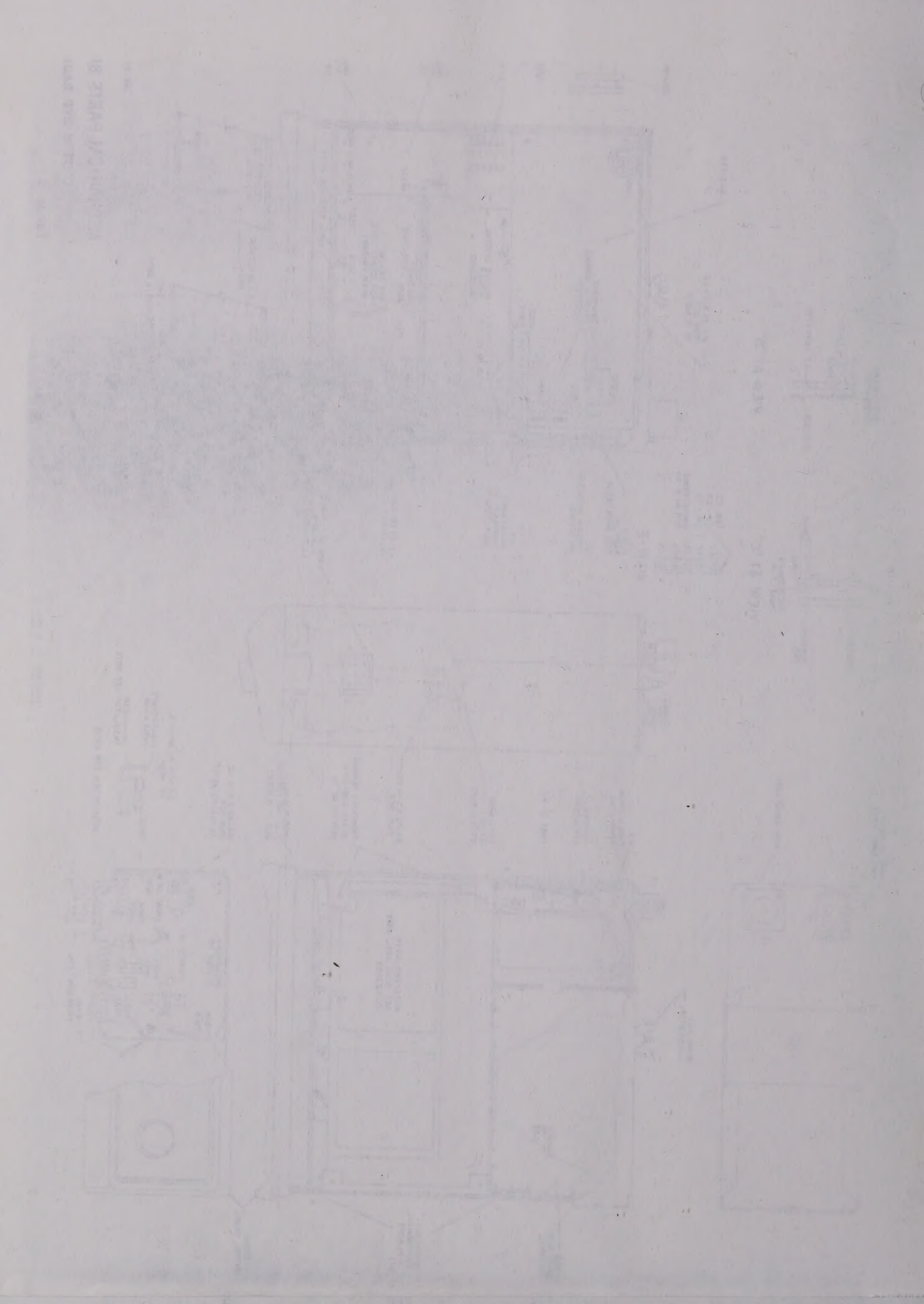
CUSTOM MVP RADI

Issue 3